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Do scientists need a philosophy?

Gerald Holton

When George Sarton began his work that led to the founding of the modern study of history of science, technology and medicine, he was concerned with questions of nineteenth-century mathematics. But searching for the predecessors of innovators was like being on quicksand. Soon he found himself at the beginning of scientific thought in Greece. From there he worked his way systematically forward, reaching the medieval period in some of his last works. By contrast, a growing fraction of today's scholars in the profession Sarton started has chosen to establish its research on the ground of recent and contemporary science, turning the historically trained eye on living cases - the rise of solid-state physics or molecular biology, modern industrial research teams or the elementary particle physics groups at CERN.

There they are struck by two kinds of discrepancy. First - at least among physical scientists, to which group I shall largely confine myself - the immense forward thrust today is neither enlightened nor diverted by epistemological debates of the kind that engaged so much energy and attention in the past, through the first half of this century (eg. on the fundamentality of discontinuity, indeterminacy, causality, wave-particle duality, the continuity of scale, etc). Only a very few scientists now write on ideas that were once at the centre of brilliant debates among the élite. It is as if there were now no major puzzles left on the level of the EPR paradox or the Bohr-Einstein debates.

The second surprise is the marked difference between the popular perception of science, which thinks of it as in a state of periodic revolution, and the contrary opinion of those who supposedly are the revolutionaries. Even among scientists one sometimes hears remarks on the "revolutionary" nature of past achievements that have become part of the corpus, such as relativity theory. But by and large they disavow the revolutionary model in favour of the evolutionary one when they speak of their own work rather than of textbook science. Thus Steven Weinberg writes on the history of physics since 1930 (in *Dandelion*, Fall 1977): "The essential element of progress has been the realization, again and again, that a revolution is unnecessary." Is this self-evaluation, today's scientists only follow in

the footsteps of their predecessors, from Copernicus down to our century.

These two kinds of discrepancy are in fact related, and can be resolved together. A convenient starting-point is Einstein's remark, now apparently out of tune with current thought even in the most active laboratories, that "Epistemology without contact with science becomes an empty scheme. Science without epistemology is - in so far as it is thinkable at all - primitive and muddled." This notion reflected an old tradition among scientists at the forefront; one thinks here of the Newton-Leibniz debates, or of the mutual effects of *Naturphilosophie* and nineteenth-century science (sometimes with grotesque results). It was not usual for a great scientist to come to the deep puzzles of his field with no interest in or naked ignorance of philosophy. Einstein recalled with pleasure the profound impression which Ernst Mach's writings made on him as a young student, and he listed some of the other authors he and his young friends studied together for self-education: Plato, Spinoza, Hume, J. S. Mill, Ampère, Kirchhoff, Helmholtz, Hertz, Poincaré and Karl Pearson (not to speak of Sophocles and Racine). J. T. Merz, writing about this period, commented that the German man of science was a philosopher; but it was not much different in other countries. Thus the American physicist-philosopher P. W. Bridgman recalled that in his last year of secondary school at the turn of the century, he read Mach, Pearson, Clifford and Stallo. At about the same time, young Niels Bohr was taking an important course in philosophy from Hoffding, and was deeply affected by Kierkegaard.

The historical record is clear: right through the first few decades of this century, a good fraction of the young scientists who came to prominence later prepared itself (whether consciously or not) for the interaction of scientific and philosophical questions, and perhaps for eventual candidacy to the charismatic chain of scientist-philosophers. We may call this the "classical" situation. The result could be found in the scientific journals of the first few decades of this century, for example in the debates on the theory of scientific knowledge between Paeck and Mach in 1909 to 1911, published in the *Physikalische Zeitschrift*; or in Minkowski's essay on space and time, in his explicit use of imagery taken from Plato; or in the difficulties the Curies had in bending their positivism enough to consider Rutherford's ideas on transmutation; or in the debate surrounding

Jean Perrin's insistence on molecular reality; or in Heisenberg's struggle with vestiges of Kantian demands of *Anschauung* and *Anschaulichkeit* in atomic physics (even in the titles of some of his scientific papers in the 1920s); not to speak of the well-known epistemological discussions between Heisenberg, Bohr, Born, Schrödinger, Einstein and de Broglie.

In different degrees these men saw themselves as both scientists and culture carriers, with the duty, or the psychological need, to fashion a coherent world picture. The most ambitious expression of that hope was the projected thirty-six-volume *Encyclopedia of Unified Science*, planned in the 1920s by Otto Neurath, Einstein, Philipp Frank, Hans Hahn and Rudolf Carnap. At least in the main Western countries before about 1945, one would have been surprised if serious, aspiring physicists had not been exposed to, and intellectually civilized by, some of the "tribal books" by scientist-philosophers of the kind young Einstein read, or by others such as those named above, or by Duhem, Schlick, Russell, Eddington, and Jeans.

This classical preparation is now dead. The "tribal books" are no longer read - with a very few exceptions the whole genre has disappeared, giving way to occasional autobiographies in the style of James Watson's *Double Helix*, or textbook expositions of straight scientific content, or, in the Marxist countries, party texts. When Sheldon Glashow was asked recently what he and his fellow students had read outside science in their formative years, he named science fiction, Immanuel Velikovsky, and L. Ron Hubbard. It is not an untypical list. Moreover, when it comes to more recent and current works in the philosophy of science, the editor's summary in the recent book *Springs of Scientific Creativity: Essays on founders of modern science* (University of Minnesota Press, 1983) seems close to the mark when he reports that working scientists on the whole now regard those products "as a debilitating befuddlement".

These uncomfortable facts raise an important paradox. For despite the decay of explicit allegiance to the scientific-philosophic tradition, science in our day is without doubt as powerful and interesting as it has ever been, both as a product and as a process. The intellectual constructs are more far-reaching in their control over the phenomena, and the

techniques more sophisticated than had been thought possible. A relatively few fundamental conceptions and metaphors provide the armatures that hold up complex structures in widely different specialisms.

One would therefore expect that the commonalities among the sciences, their shared philosophical underpinnings, would be more evident in scientific activity than ever. But this is precisely what we do not find. Therefore, two questions arise: How did this come about? And how can science be done so well without the conscious contact with epistemology that characterized the classical mode?

The first question can only be touched on here. It would be folly to think that the deep questions which explicitly preoccupied scientists for centuries are of no further interest because they have been answered. Rather, they seem to be in a state of hibernation. In their place, new extra-scientific sources of stimulation and strength have appeared during the past few decades, new sociological externalities that are considered more nourishing than a continuation of the self-conscious introspection of the previous decades. These new factors include the large increase in the number of scientists, of funding sources, of administrative structures that represent long-range commitments. These in turn brought the better support of bright students, the greater strength of professional societies and their journals, the greater freedom for scientists in the West to travel and become part of the international community.

The ever-closer collaboration of science, technology and engineering has also had a transforming effect. This is obviously the case for the experimentalists, whose apparatus design, data reduction skills, computerization, and organization in big teams were all markedly shaped by what they learned during their engineering-directed service in the laboratories of the Second World War and its Cold War aftermath, and by the ready-made equipment available from industry. A striking example is the direct link between military technology and the confirmation in 1959 of Gell-Mann and Nishijima's prediction of the cascade zero in particle physics. The huge seventy-two-inch liquid-hydrogen Bubble Chamber used for the test was constructed and operated under Louis Alvarez's excellent team of structural, cryogenic and accelerator engineers, putting to use skills developed in military laboratories from the Manhattan Project to the Eniwatok hydrogen-bomb test (in fact, the compressors used

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in the seventy-two-inch chamber had initially been made and used during that test in 1952). But not only the experimentalists were affected by those links. Thus Julian Schwinger, who worked on electromagnetic problems of microwave and wave guides in the early 1940s (as, in fact, did Sin-iti Tomonaga on the opposite side), later applied the methodological lessons of this work to the effective-range description of nuclear forces, leading to the concept of renormalization. Willis Lamb similarly traced his discovery of the "Lamb shift" to his wartime work on magnetrons.

Such externalities can account only in part for the recent somnolence of the old philosophizing impulse. Another factor in the flight from what is now considered "debilitating befuddlement" may well be the perception by the large majority of scientists, right or wrong, that the messages of more recent philosophers, who themselves were not active scientists, are essentially impotent in use, and therefore may be safely neglected. The possibility of this harsh judgment may be illustrated by the testimony of two well-placed observers. The first is Hilary Putnam, himself a philosopher of science at Harvard University. In his essay, "Philosophers and Human Understanding" (in A. F. Heath ed, *Scientific Explanation*, 1981), he argues that in the end the main schools of scientific philosophy, despite their early promise and their hold on the imagination of major scientists in what I have called the "classical" period, turned out to be failures. The early positivists, building on Frege and Mach, inspired the vain hope that the scientific method, including its inductive core, might turn out to be an algorithm, a mechanical proof procedure that permits "rational reconstruction". Today, Putnam reports, it is widely agreed that this is impossible, for there is always a need for judgment of "reasonableness". (Ironically, this liberalization has allowed anarchism to put in its strident claim here and there.) But scientific understanding is human understanding after all, differing only in so far as research scientists

are more concerned with the discovery of scientific progress is not solving a puzzle once and for all, but the evolving emergence of tolerable solutions from which better problems will become available for future work.

The verification principle of the logical positivists, that nothing is rationally verifiable unless it is critically verifiable, did indeed serve well to free scientific thinking from the fetters of explicit metaphysical doctrine in the nineteenth century. But Einstein had sensed the limits of this service earlier than most. As he wrote to his friend Michele Besso (May 13, 1917): "I do not inveigh against Mach's little horses, but you know what I think about it. It cannot give birth to anything living; it can only exterminate harmful vermin." Summing up the results within philosophy six decades later, Putnam's judgment is more sweeping: that the work of the logical positivists and the recent post-positivists has been refuted, and is self-refuting to boot. That is of course not to say that rational argumentation and justification are impossible. But the attempt to consider them certifiable by appeal to public norms is an absolute delusion. To this, the student of case histories of modern physics adds a specific point: that if the claims of falsificationism had merit in earlier science, when the chain of hypotheses was shorter, it hardly corresponds to successful scientific practice today. On the contrary, it is striking how often a theory is delayed or abandoned because of initially credible experiments that turn out to have been flawed. In this manner, Schwinger's close approach to a successful electro-weak theory was blocked in the 1950s, and the acceptance of weak currents was long delayed.

In sum, Putnam's judgment amounts to a declaration that by its own criteria much of recent philosophy of science has been a degenerating research programme. Coming from the other direction, the voice of a practising scientist reinforces that of the practising philosopher. In his essay in the same collection, "Rationality and Science", Henry Harris, the Regius Professor of Medicine at Oxford, provides an urbane analysis that amounts to a withering indictment parallel to Putnam's. He finds, for example, that the works of the most senior among current philosophers of science

"not only undermine the classical picture of scientific method . . . [but] also eventually undermine his own position, so that nothing in the way of a coherent logical structure for science remains". The methodological rule specifying which hypothesis to prefer (ie, the one with greater empirical content) is, "on the face of it, an attractive notion, but is of no use at all to the practising scientist" - in part because the "empirical content" can't be known in advance, but unfolds as the hypothesis is explored. And the conception that the work of scientists replaces one hypothesis by another in unending series, whether commensurate or not, neglects that they "provide facts", facts that don't have to be changed; blood does circulate.

Moreover, a discussion of what induction from oft-repeated observation can tell about the future is also off the point, for a scientist does not blindly repeat his own or another's experiments; he deliberately introduces changes to get more information. To make the point, Harris says simply, "He kicks the problem around", and he adds the initially shocking thought that what appears as philosophical naïveté (as in the intuitive acceptance of rational realism) can in fact be a fruitful mode of operation at the bench. Indeed, if scientists in the past listened to philosophers, the converse should be true in our day: the claims of a "logic" of scientific discovery do not stand up to a "detailed study of what scientists actually do". No list *a priori* makes a hypothesis intrinsically more probable to be right than its rivals. The best strategy is, again, an evolutionary one, in which the value of hypotheses is found *a posteriori*.

Professor Harris, a philosophically sophisticated scientist, ends with the judgment of laboratory common sense: "Rationality helps, but it is not a prescription for making discoveries." The "rational scientist", therefore, is a "thorough-going empiricist who never troubles his head about the logic of what he is doing". He makes mistakes, but also gets things right. He has no reservations about the ability of scientific procedure to verify and to falsify scientific propositions, and he submits his publications in the hope that others will build on what is valuable in them.

What emerge from such accounts are some characteristics of the post-Second World War styles of the scientific imagination - styles productive of superb results even if unappealing to

some of us who were brought up in the earlier setting. (In this, as in other ways, there may be more than an analogy with the contemporary scene in the pictorial arts, music and literature.) If the older role models were the philosophically introspective Poincarés or Buhrs, the newer ones are the apparently philosophy-immune successors of the brash young experimentalist Rutherford - who had no hesitation in proposing the near-alchemical conception of transmutation, typical of his constant stream of hypotheses and simple metaphorical explanations - or the totally agnostic Enrico Fermi, of whose immensely successful theoretical work Bohr was reported to have said in dismay that it was tainted in "too elementary" a way, too "cheaply". Einstein's constantly repeated epistemological credo was, after all, also a plea for liberalization from school philosophies, for the useful role of "free invention". And Bridgman's simple dictum, "The scientific method is doing one's damndest, no holds barred", signalled a self-confidence, a scepticism of methodology, and an impatience with earlier authority that have become earmarks of modern scientific practice.

The success of this style seems to have entered even into the selection process by which young collaborators are chosen. Maxine Singer, chief of the Laboratory of Biochemistry, National Cancer Institute of the National Institute of Health in the United States, recently spelled out the desired characteristics of young scientists brought into the laboratory. A high value is placed on the "degree to which they challenge their senior colleagues" in scholarly discourse. She sees the necessity of preserving such "troublesome inclinations for their motivating force" as may be found in evidence of ambition, aggressiveness, even belligerence. She believes it is up to the social organization of science, in the words of Jacob Bronowski, to "transmute these brutish energies into disciplined inquiry by the community as a whole".

Eric Ashby, fifteen years ago, made a similar point. To prepare a person to participate in research, we must first make him familiar with "the orthodox dogma", but then instil in him the principle of "constructive dissent: it is this discipline of dissent that has rescued knowledge from remaining authoritarian and static". Dissent, shading into unbuttoned irreverence: one recognizes the traits of a young Francis Crick or Richard Feynman.

Self-propelled by an epistemological confidence, encouraged by the ability of his men-

tor to suspend disbelief in the face of "disconfirming evidence" for long periods, the scientist now has early and continuing psychological support for risking hypotheses that, in my view, would have had much difficulty in the first half of this century passing through the filter of presuppositions. The unkempt style of today shows up in the very terminology proposed for new scientific concepts, forcing the *Physical Review* editors on occasion to reject risqué neologisms - a problem that, say, Max Planck, as editor of the *Annalen der Physik*, could not even have imagined. Moreover, the older *sine qua non* of sound work such as the sturdiness of hypotheses connecting the observed events to the underlying theory, or the quick repeatability of new phenomena, has become technically almost impossible in many advances - in research that involves large teams, when complex and expensive apparatus exists in the given form only in one place, when the search centres on a very evanescent signal in the noise. An exemplar of this syndrome is the exhibition of a single (or "gold-plated") event in the bubble chamber, as in the proof of the existence of the omega-minus particle or the demonstration of the K⁰ decay process (P. Galison, *Reviews of Modern Physics*, v.35, 1983). We have come a long way from the reluctance of J. C. Street, who in 1937 had only a single cloud-chamber picture of the muon, and so hesitated to claim the discovery of the new particles.

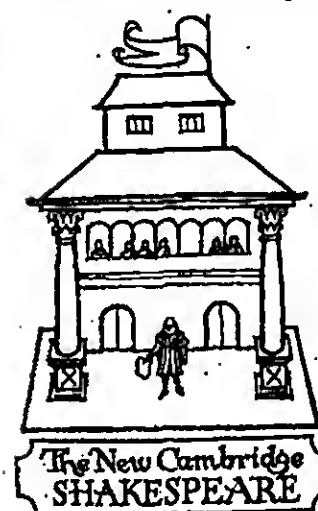
But if unepistemological confidence now were all, what prevents the process of innovation from degenerating into mere fantasy? If that were the main strategy for scientific research, it would act in most cases as a centrifugal tendency, leading soon to a crossing beyond the frontiers of good science. What prevents physics from becoming a conglomeration of astrology? Why not anarchy? Some sort of sound epistemology must be at work after all, even if it is subterranean or not fully conscious. Therefore we should look for offsetting, centripetal tendencies. And this is just what we shall find. But we have not yet exhausted the characteristics of the modern style. The almost improvisational heuristic (in Whewell's sense of the word heuristic: serving to discover) sometimes seems like pole-vaulting over obstacles. Thus the twenty-nine-year-old Sheldon Glashow, in his paper on "Partial Symmetries of Weak Interactions" (*Nuclear Physics*, 1961), on which his 1979 Nobel Prize would be based, announced simply: "The mass of the charged intermediaries must be greater than [zero], but the photon mass is zero - surely this is the principal stumbling block in any pursuit of the analogy between hypothetical vector bosons and photons. It is a stumbling block we must overlook."

The new physicist is unimpressed by those among his forebears who, having read Mach or Pierre Duhem, had trained themselves assiduously to avoid theories containing empirically unmeasurables; he is equally neglectful of more recent philosophes of science that earnestly invoke demarcation criteria and threaten to claim that elementary particle physics is a "degenerating research programme". None of these dampens speculative proposals as long as there is felt to be "good reason" - but in the sense in which a "good hypothesis" is one that has already been corroborated, or even better, Carnap's sense, where "good reason" is equivalent to high probability. Rather, "good reason" is part of an expression of the risk-taking, "what-if?" improvisational heuristic that allows proposals to be made without regret even when they have highly implausible aspects, or when tests are not likely to be possible in the foreseeable future. Thus C. N. Yang and R. Mills pioneered gauge field theory in a paper of 1954, despite the prediction inherent in their theory that there should exist charged but massless particles. And Glashow wrote in the *Physical Review Letters* (with H. Georgi, January 1974): "We present a series of hypotheses and speculations leading inescapably to the conclusion that SU(5) is the gauge group of the world - and that all elementary particles are different manifestations of the same fundamental interaction involving a single coupling strength. . . . Our hypotheses may be wrong and our speculations idle, but the uniqueness and simplicity of our scheme are reassuring."

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John 12:16

enough to be taken seriously."

"Reason enough" is a simple short-circuit across acrimonious debates on warrants for rationality. The closest philosophical predecessors of the reason-enough style are David Hume and Charles S. Peirce. Hume distinguished between what is rational and what is reasonable, and allowed criteria of "reasonableness" even when the basis of the original judgment was ultimately only intuitive. Peirce, the nineteenth-century American mathematician-philosopher and originator of Pragmatism, thought of creative work in terms near to Galileo's "il lume naturale" of reason, and akin to Kepler's readiness to let his presuppositions interact with the empirical material before him. Peirce's is not the logic of discovery from books, such as Descartes's or Bacon's, but a logic-in-use. His process of inductive inference is powered by the unshamed proposal of forward-looking hypotheses that are scrutinized, and made corrigible by experience and disciplined thought—not only by its originator, but by the community of scientists, engaged in the self-correcting process of public discourse. The warrant for any scientific innovation lies in the future, in the outcome of further inquiry. He wrote: "The test that can be done is to supply an hypothesis, not devoid of all likelihood, in the general line of growth of scientific ideas and capable of being verified or refuted by future observers." To this future-and-community orientation, Peirce adds an action orientation. The concepts used in scientific discourse were to be what later came to be called operational: "The meaning of a concept . . . lies in the manner in which it could conceivably modify purposive action, and in this alone."

This attitude, verging on the outrageous when first proposed, has since become an element of the implicit lore and tool-kit of most scientists. Few among them would be able to cite a source either for this operational credo or for the discussion among philosophers of its highly problematical nature. They are now far from alone. The philosopher has to admit it. They see the scientist's chief duty to be not the production of a flawlessly carved block, one more in the construction of the final Temple of Science. Rather, it is more like participating in a building project that has no central planning authority, where no proposal is guaranteed to last very long before being modified or overtaken, and where one's best contribution may be one that furnishes a plausible base and useful material for the next stage of development.

This methodology-in-action-and-for-the-future is well described in a metaphor proposed by Putnam. He modifies Otto Neurath's picture of science as the enterprise of constructing a boat while the boat floats on the open ocean.

"My image is not of a single boat but of a fleet of boats. The people in each boat are trying to reconstruct their own boat without modifying it so much at any one time that the boat sinks, as in the Neurath image. In addition, people are passing supplies and tools from one boat to another and shouting advice and encouragement (or discouragement) to each other. Finally, people sometimes decide they do not like the boat they are in and move to a different boat altogether. And sometimes a boat sinks or is abandoned. It is all a bit chaotic; but since it is a fleet, no one is ever totally out of signalling distance from all the other boats. We are not trapped in individual solipsistic hells (or need not be) but invited to engage in a truly human dialogue, one which combines collectivity with individual responsibility."

This lowering of explicit epistemological barriers has resulted in sociological effects peculiar to contemporary science. A larger number of practitioners feels invited to participate; more students, even undergraduates, can take part in research on frontier problems, and appear as co-authors of publications. The size of teams is growing steadily, with the maximum now around 150 and heading to even higher levels. Similarly, the number of competing and mutually reinforcing teams is growing, as more daring problems are being attempted and the collaborative benefits of problem-solving are proving themselves in practice. The absence of idiosyncratic epistemological commitments also has the advantage of easing international collaboration, as the differences between national styles have been disappearing. Correspondingly, persisting differences between schools of thought within a given nation are now rare. The walls between disciplines have also become more permeable. On this last point, the useful intrusion of technology and engineering into physics has been mentioned; a similar finding extends to the other natural sciences and to mathematics.

As we noted, the centrifugal tendencies, if left to themselves, should be tearing science apart. They cannot do so because they are only one part of the total armamentarium. As soon as we also include the unacknowledged and often subterranean modes of scientific thought, we find a centripetal tendency at work also, and Einstein's dictum on the necessary links between science and epistemology turns out to be correct after all. In brief, the free leap made during the process of innovation is still bounded by an adherence, unconscious but strong, to long-established and enduring conceptions. Moreover, controversies between scientists are at bottom still about differences concerning which of these old conceptions to give one's full allegiance to. These attachments are what makes contemporary science a recognizable offspring of earlier science. We can safely predict that they will also connect the future state of the field, despite all apparent changes, firmly with the present.

The enduring elements to which I refer are somewhat like the old melodies to which each generation writes its new words. They are the *thematic concepts* (such as evolution, devolution, or steady state); *methodological themes* (eg, the practice of expressing regularities in terms of constancies or of extrema; or forming rules of imputancy); and *thematic hypotheses* (such as the postulation of the discreteness of electric charge, or the wrong hypothesis of continuity for light energy, widely held for years after contrary evidence was at hand). I have discussed at some length in case-studies how such thematic materials can guide individual decisions—whether to success or not—either during the nascent phase of scientific work, or during controversies between rivals. Thus, from the very beginning of modern science, a presuppositional allegiance to the plenum, or to either atomism or the continuum as a ground of explanation of phenomena, has shaped the way scientists have used the other main components of their discourse, namely the empirically available content and the analytic devices of logic and mathematics. Such a presupposition can explain how Max Planck, at an early age, could predict confidently that the assumption, by different schools, of finite atoms and of continuous matter respectively would "lead to a battle between these hypotheses in which one of them will perish," and he added his bet that despite the "great success of the atomic theory [it] will ultimately have to be abandoned in favour of the assumption of continuous matter."

In this, Planck agreed with Einstein, who put the hypothesis of atoms and quanta to supertest but nevertheless thought that the basic explanations will ultimately have to come from the continuum. Among the other themes which a scientist's theory of construction

reveals are these: primacy of formal rather than materialistic explanation; unity or unification, and cosmological scale (applicability of laws throughout the total realm of experience); logical parsimony and necessity; symmetry; simplicity; causality; completeness; and invariance. His attachment to these themes explains in specific cases why Einstein would obstinately continue his work in a given direction even when tests against experience were difficult, or unavailable, or apparently disconfirmatory.

Although themes are rarely verbalized and hence cannot be found in the index of textbooks, an analysis of contemporary physicists' writings will yield most of the thematic concepts that were active in Einstein's days, plus a few other well-established ones such as the methodological theme of using metaphors, or of establishing conceptual hierarchies. There are now also a few differences from Einstein's list, such as the new presupposition in favour of fundamental probabilism, the anti-theme to classical causality. The stability of the scientific enterprise despite the profound changes during the past three centuries is largely due to the longevity of most reigning themes, as well as of the choices given by theme-antithema couples; the relatively small number of them; and the remarkable rareness of the need to introduce a novel thematic concept (complementarity and chirality being the last major new entries in physics in this century).

It will suffice here to mention only what may be the most ancient and persisting of these thematic conceptions, acting as a motivating and organizing presupposition to this day. It is of course the attempt since Thales—hence dubbed the "Ionian Fallacy"—to unify the whole scientific world picture under one set of laws that will account for the totality of experience accessible to the senses. One aspect of this commitment is the hope, ever new in detail but the same in essence, to achieve a unification of all the forces of nature. Oersted was committed to finding it before doing the experiments that revealed the link between electricity and magnetism; Faraday called it a "dream" he hoped to realize for all forces, including gravity; Einstein devoted more time to this dream than to anything else; Julian Schwinger called it the "grand illusion"; and in its current version it is in full swing today in the attempts to fashion versions of a Yang-Mills gauge field theory able to account for every particle, every force, through a single principle.

It was precisely in the pursuit of the unification of electromagnetic effects and phenomena associated with weak interactions that Glashow in the early 1960s said he would suspend his disbelief in the face of apparent paradox, and would "overlook" that stumbling block. It was in the service of the conception "that all elementary particle forces . . . are different manifestations of the same fundamental interaction," together with the thematic belief in the uniqueness and simplicity of the schema, that Glashow and Georgi wrote in 1974 there was "reason enough" to take the scheme seriously, years before any tests became feasible, and despite their confession of being forced to build "outrageous ideas" into the theory.

That illustrates the chief point made under this heading: the apparently unapologetic style today is still in the service of an ancient quest, transmitted from generation to generation: the pursuit of a few basic themes—by their very nature unverifiable and unfalsifiable presuppositions—that help to guide the search for order, though always disciplined by eventual accountability to sharable experience. The modern philosophers' apparatus of strict demarcation criteria, or the logic of justification, or the supposed incommensurability of successive stages of science, has not been able to deal with the persistent thematic side of the scientific imagination. Yet it is the latter, the old internally directed or centre-seeking part of the process, which serves as the counterpart to the new, externally directed or centre-fleeing element in it. Together they stabilize each other, while leaving the necessary elbow-room for the imaginative act.

We return finally to the issue with which we began, whether science is in a state of constant or frequent revolution, as is popularly perceived, or is upstaged and by the scientific method

frontiers. The eye and ear of the outsider tend to miss evidences of the continuity of the scientist's allegiance to a few well-established, persisting themes even through drastic changes of analytic or phenomenological detail, a continuity that reminds and assures the individual scientist of his connection to his historic forebears. Despite all superficial differences, as elementary particle theorist might be (and in fact has been) overheard to say: "We might now stand in a position analogous to that of Oersted, Ampère, and Faraday"; began locating himself on the trajectory. In just this way, Einstein constantly protested that the relatively new theory of space and time, "not differing radically" from the development initiated by Galileo, Newton and Maxwell.

To regard one's own work as truly revolutionary would require the discovery by the scientist concerned that the whole set of thematic presuppositions on which he and his contemporaries have been relying turns out to be in need of replacement by the corresponding antithemata. That would indeed make the new incommensurable with the old. But such a wholesale change is quite unlikely to happen. (The one scientist who came close in this century was the young Heisenberg.) The main thrust has been and undoubtedly will continue to be the continuation or slow evolution of the few core ideas. That is not to say that scientists all hold the same set of thematic beliefs, or are equally well served by them, or cannot differ drastically on some deep issues, or that one cannot discover when a thematic choice is not functional and must be abandoned. But the individual spectra of thematic commitments active at any time in the scientific community show considerable overlap, and hence ground for agreement. Therefore even a far-reaching change such as that from Maxwell's work to Einstein's requires for the individual or the community no conversion, Gestalt switch, or similar dramatic discontinuity of all beliefs, but merely the eventual accommodation of a few components out of the otherwise largely invariant set of current themes.

This analysis of current dimensions of scientific innovation might prompt the question: What has the energy of explicit philosophy among scientists gone? Perhaps that is a pseudo-problem. But if there exists a natural tendency to such conscious introspective activity, it may be that it has been merely repressed from concerns of the individual to the problems of the scientific community at large (in a shift parallel to that concerning the value of hypotheses). Thus the anxious individual inquiry into the warrant for rationality has been replaced by discussions among some scientists of questions coming from another branch of philosophy, namely ethics. (In a sense this returns scientists to the concerns of Socrates, and to the ideas, in seventeenth-century discussions, of the parallelism of scientific and political progress.) The professional societies of scientists (the American Physical Society, the American Chemical Society, etc) have become notably involved in questions of ethics and human values, such as the access to science of previously disadvantaged groups; the rights of scientists to object to unethical practices; the human rights of colleagues in totalitarian systems; the desperate need for arms control, as well as for a sharing of scientific resources with Third-World countries.

To a degree unimaginable a few decades ago, scientists are discovering that there is a morality which the enterprise of science demands of itself—even if such concerns are expressed by only a small fraction of the total community. Indeed, with about one-third of the world's scientists and engineers working directly or indirectly on military matters while the arms race proceeds unchecked, the transfer of attention from apologetic to ethical problems may be too little and too late. At this ominous juncture of science and history, as we watch the growing reign of the irrational in world affairs, the debates of former times to give precision to scientific rationality seem curiously antiquated. Perhaps this redirection of philosophical concerns signals a growing awareness that the process of scientific innovation is not in danger—but that the scientific method is in danger.

Dirty laundry of a dynasty

Anthony Howard

PETER COLLIER and DAVID HOROWITZ
The Kennedys
\$76pp. Secker and Warburg. £12.50.
0436105519

Mora successfully than any other political family, the Kennedys contrived for some years to control what was written about them. First in the field were the pall-bearers of the legend of Camelot—Arthur Schlesinger Jr, Theodore Sorensen and Pierre Salinger. Scarcely had they completed their work of raising one literary misadventure after another under construction, this time dedicated to the memory of the President's brother Bobby (with Arthur Schlesinger Jr again acting as the master mason). The eternal flame that burns over John F. Kennedy's grave at Arlington Cemetery evidently represents no idle theatrical gesture: so far as the family was concerned, it reflected from the beginning a deeply felt political imperative to see to it that, like John Brown's soul, the Kennedy myth went marching on.

"Today, like my brothers before me," announced Teddy Kennedy soon after the funeral of his second brother in June 1968, "I pick up a fallen standard"—and it says something for the hold the Kennedy myth had by that stage acquired on the minds of the American people that, even in a supposedly democratic society, no one should have looked askance at so nakedly dynastic a claim. Later on, of course, as a result of Chappaquiddick and other happenings, that mood changed—so much so that by 1980 it was possible for President Carter to remark, apropos Senator Edward Kennedy, "I am going to whip his ass" (and not only to get away with saying it but actually to fulfil his boast).

As with political life, so with the output of books. In terms of publishing, the Kennedys, despite their display of muscle over such works as William Manchester's *Death of a President*, have long since ceased to count as a protected species. While in the 1960s it seemed almost blasphemous for iconoclasts, like Gore Vidal or Malcolm Muggeridge, to write articles poking fun at "The Holy Family" or "The Loved Ones", such simple irreverence today is the least of the threats the Kennedy legend has to contend with. Over the past ten years, thanks to the efforts of Mafia molls and even some belated confessions from the more flyblown countries of Camelot, the skeletons have come tumbling out of the Kennedy cupboard.

It was plainly time for a *Dallas* or even *Dynasty* treatment of the family—and in their new book two former *Ramparts* journalists from the West Coast (with a similar work on the Rockefellers already behind them) have done their best to provide it. There is in no sense a political biography. Instead, it represents—complete with exhaustive family trees and photographs of the various generations at different stages of their careers—a skilful adaptation of *The Forsyte Saga* formula from English fiction to contemporary American journalism. The early part, admittedly, starting with the arrival in 1849 of Patrick Kennedy in East Boston from County Wexford in Ireland, is little more than a conscientious chronicle—and one, moreover, that cannot help seeming somewhat derivative from Richard J. Whalen's *The Founding Father*, first published twenty years ago.

But once P. J. Kennedy (Patrick's son) and John Francis Fitzgerald (the legendary "Honey Fitz") are out of the way, the narrative picks up pace and momentum. Peter Collier and David Horowitz have made good use of the various memoirs that have come out since Mr Whalen's book first appeared—and Gloria Swanson's autobiography, in particular, enables them to provide a graphic account of the most famous (though by no means the only) colourful affair of Ambassador Joseph P. Kennedy's life. It is all too easy, indeed, to envisage it as an episode in a new "drama-doc" TV serial with the final shot fading on the Ambassador pulling at Miss Swanson's kimono and murmuring "No longer, no longer, now!" Mr Collier and Mr Horowitz show, in fact, a healthy commercial interest in sexual activity

throughout (at another moment we are given a further private glimpse of the Ambassador, this time undoing his own bath-robe and, leaning over the bed of one of his daughter's friends, whispering: "This is going to be something you'll always remember"). But what, of course, gave this book its place on the best-seller list in America is not its vivid account of the Ambassador's infidelities but rather the splittures and appetites he handed on to his sons. Here, again, nothing is spared—down to and including the (surely apocryphal) tale of Jacqueline Kennedy producing a pair of panties she had found in her pillow-slip in the White House and saying to her husband, the thirty-fifth President: "Here, would you find who these belong to? They're not my size."

It would be wrong, however, to dismiss the whole narrative merely as an up-market version of *What the Butler Saw*. Collier and Horowitz have not only read exhaustively, as their source notes demonstrate; they were also fortunate enough to enjoy one major "break" in getting at least one member of the Kennedy inner circle to talk to them without any form of inhibition and, furthermore, to hand over every letter he had ever received from the Kennedy family. His name was Kirk LeMoyne Billings, he was J.F.K.'s oldest friend and

(although he died in 1981) the authors are probably justified in claiming him as "the Ishmshel" of their entire enterprise.

Others, however, may be tempted to think of another Biblical name to describe him. For the starkly disturbing part of this book is not the often tawdry account it gives of the frailties and weaknesses of the last Kennedy generation to make it to the top in American politics; rather it is the hitherto untold story of the vicissitudes and vulnerabilities of the successor Kennedy generation—the twenty-seven (soon to be twenty-eight) children left behind, almost as a tribe that had lost its head, at the time of Senator Robert Kennedy's murder in June, 1968.

To them Lem Billings, inadequate though he was with his taste for both drugs and drink, appears to have acted as some sort of Svengali—his New York apartment serving as a "crash pad" for trips of more than one kind. The last section of this ill-written but compulsive family saga makes, in fact, for extraordinarily chilling reading—hardly made any more palatable by the disclosure (surfacing only in the final bibliographic note) that it was while extracts from it were being serialized in an American magazine that another of the authors' sources, young David Kennedy, was found dead in a Palm Beach motel room.



Members of the youngest generation of Kennedys with Kirk LeMoyne Billings, reproduced from the book reviewed here.



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There is a fashionable notion gaining ground that likens Dr David Owen to Sir Oswald Mosley. The leading article in a recent edition of the *New Socialist*, complete with full-colour caricature on the cover, portrayed Owen as another handsome, autocratic young man in a hurry who had no business ever to have been in the Labour Party and now, having helped to found a new party as a vehicle for his overweening ambition, was leading it rapidly to the right. There are, of course, some points of superficial similarity, though one of the least remarked is the fact that Owen was always the odd man out among the "Gang of Four". He was still a doctor at St Thomas's Hospital when Roy Jenkins, William Rodgers and, in a more junior capacity, Shirley Williams were fighting the Gaitskellite battles of the early 1960s; he is thus less of an old pro than they (who have never been anything but professional politicians) and carries much less old Labour Party baggage. (He may be in some ways more "radical" than Roy Jenkins, but it was pure image-making for his supporters in the 1982 leadership contest to claim that he was, in any

traditional sense, further to the left.)

Nevertheless, emanating from the left, the companion is no more than a gleeful smear, intended to discredit Owen with those who know of Mosley only as a ranting fascist. Any personal similarity quickly breaks down on the fact that Owen, while undoubtedly self-confident and a loner, is so plainly not an aspiring Fuehrer but, as this collection of his recent speeches clearly shows, a thoughtful, consensus-seeking democrat only too well aware of the difficult choices of the modern world. Where a pale comparison is sustainable, on the other hand, it is rather to Owen's credit. For Mosley in the late 1920s, before he collapsed into fascism, was doing the most creative thinking of any politician in any party, picking up and trying to fly, almost before they were hatched, certainly before they were politically fledged, the "Keynesian" ideas of demand management that were to revolutionize the next half-century. Owen has not Mosley's daring; but in his less flashy way he is showing himself—largely because his situation allows or compels him to be—the left-of-centre politician most sensitive to a similarly major shift in the intellectual climate and the political mood of the moment.

The nature of that shift is analysed—or rather celebrated—by Geoffrey Sampson, Professor of Linguistics at Leeds, in an admirable plain man's guide to the New Right. His thesis—argued in deliberately non-academic language which at its best reads like the purest common sense but at other times relies too much on impressionistic hearsay—is that worldwide but specifically in Britain there has taken place in the past few years a wholesale rebellion against the "nanny State". "People are

becoming convinced that ordinary individuals can run their own lives better than any corps of benevolent mandarins or Big Brothers can do it for them. Authority in all its forms is distrusted as never before in modern history." This, Sampson argues, is not just a temporary phenomenon reflected in the result of two General Elections but the long-term reversal of the tide of progressive state interference regulation and provision which flowed strongly from the middle of the last century until perhaps ten years ago, shaping the attitudes and assumptions of Conservatives scarcely less than of socialists. That tide he now expects to recede as inexorably as it came in.

That there is a widespread popular reaction against big government, nationalization, council housing and benevolent bureaucracy generally is an observable fact. The conventional wisdom now is that big government is in practice neither benevolent nor efficient in achieving the goals it sets itself. Whether the public will ever become so convinced as Sampson would like to believe of the superiority of the "invisible hand" in securing its health, security and personal fulfilment through the marketplace is very much more doubtful, though his enthusiasm is intellectually seductive. His chapter exposing the arrogant mystification of the "expert" professions, specifically architects and doctors but not sparing academics, will raise an almost universal cheer; but those on other theorists (mainly American) who can reduce all human behaviour, including even sex, to the discipline of the market, will strike most people as the stuff of fantasy. Ultimately his libertarian vision is as utopian as the managed utopias he so effectively derides.

But of course Sampson is a lobbyist at

mould-breaking ideas, not a politician, though he ends up with a stirring call to arms: "Spread the word. Don't let up. It is our own lives we are fighting to take control of. If you help we can win." He does not expect outright victory next week, or probably ever, so he can afford to strain our credibility. David Owen, by contrast, has to plan for electoral victory and temper bright ideas to practicality. That is one reason why his book, by comparison with Sampson's missionary verve, makes worthy but dull reading: a true pragmatist, determined not to appear woolly, he is trying to construct his new synthesis out of concrete instances, not generalities. The more important reason is, of course, that he does not share the full faith, anyway: he is merely trimming his formerly socialist assumptions to the changing wind. There is nothing dishonest or dishonourable in this; on the contrary, it is a democratic necessity, to which even what must now be called the Hattersley wing of the Labour Party would dearly love to be allowed to bow.

The point is that Owen and the SDP can do it, while Kinnoch and Labour almost certainly cannot. Thus while Owen has not the least intention of dismantling the National Health Service or abandoning any of the social objectives of the Welfare State, the whole thrust of his politics is to see how far the institutions of state regulation and provision can be decentralized, decentralized and otherwise made more responsive to the consumer, the taxpayer, the patient, the parent and the voter. Owen's glamorous search for a practical means of achieving "left-wing" social goals by borrowing "right-wing" economic methods is a very long way from Sampson's idea of the "new politics" (or Mrs Thatcher's, which is different again).

Patrician among premiers

Kenneth O. Morgan

FRANK LONGFORD
Eleven at No. 10: A personal view of prime ministers 1931-1984
189pp. Harp. £9.95.
0 245 54228 0

In the course of a kaleidoscopic, sometimes bizarre, public life, Lord Longford has played many parts. But high politics has always been a central thread. He has been caught up in party politics from his youthful days in the Conservative Research Department in the early 1930s, to his active time as a Labour peer since 1945, including government office under Attlee and three years of Cabinet experience under Wilson. He has also been a versatile biographer, his subjects ranging from Richard Nixon to Jesus Christ. This varied experience, both as participant and as commentator, provides the basis of this attractive, if lightweight, series of sketches of the eleven prime ministers, from Baldwin to Thatcher, whom he has encountered, one way or another, over the past fifty years. Some of these essays, especially of the earlier premiers, take us no further than the conventional assessment. Baldwin and Chamberlain are dealt with impressionistically (with some recycling of stories from Lord Longford's earlier autobiographies). Churchill is worshipped, mostly from afar. Thatcher emerges as ferocious but somewhat baffling. Post-war Conservative premiers—Eden, Macmillan, Home and Heath—are treated mostly in anecdotal fashion, though some of the stories (for example, Macmillan's approach towards the return to Ireland of the Lane bequest of paintings) have much fascination. The generalizations on the typology of twentieth-century British prime ministers do not take us very far, while no speculations are ventured on such constitutional problems as the notion of "Prime Ministerial government" in the post-Lloyd George era.

At the same time, there is much period charm and some incidental insight, which will gain these essays a wide general readership. Longford, not surprisingly, is most perceptive on the three post-war Labour premiers. He adds his mead of tribute to Attlee's methods of running his administration and to his social conscience. Like other recent writers, he takes Attlee's tactfulness as a sure index of intellec-

tual profundity. He does not consider the possibility that at times Attlee, especially on economic questions, simply had nothing to say. There is an engaging story of how Longford tried to bring Beveridge into the Labour Party during the war by arranging a meeting with Attlee at a London club. Attlee dined on Beveridge's hectoring style and eventually fell asleep. By the time he had been roused, Beveridge himself had fallen asleep. Beveridge did not join the Labour Party.

Longford also revives the flagging stock of Harold Wilson by reminding us anew of his many personal kindnesses and generosity towards colleagues, as well as of the social legislation of 1966-70. Disappointingly, we hear little of the closer Wilson entourage, apart from a sentence which tells us, typically, that "Lord Home gave Harold Wilson much pleasure by coming to a lunch given by my friend Lord Kagnn to welcome him to the House of Lords". The most stimulating study is of Callaghan, who is praised not only for his known political skills but also for being "the most natural orator" of all eleven premiers, a just enough verdict. There is a remarkable story of how, anxious for Longford's support in opposing devaluation in 1966, Callaghan arranged for him to see both Robert Nield (arguing against devaluation) and Sir Donald MacDougall (arguing for). Evidently, like a peacock, Callaghan was anxious not only that Longford should be right, but that he should be right for the right reasons. There are, then, some interesting nuggets, while every observation upon Irish affairs is worth attention; of course, nearly fifty years ago, Longford wrote a marvellous monograph on the 1921 Anglo-Irish treaty, still the best book on the subject.

Longford is a genial, charitable umpire, prepared to give virtually every one of his eleven a benefit of every doubt. (There are hesitations over Chamberlain, Heath and especially Mrs Thatcher, whose diabolic voracity seems to frighten him.) Most are praised for their commitment to Christian values, especially Baldwin, Attlee, Callaghan and especially Home earning high marks from this eager selytizer. Another source of comfort in a painful world is that seven of the last eight (Callaghan) had strong links with Nuffield College. What Longford would or could make of a Ripon membership cannot be imagined, but perhaps even there love would conquer all.

The path of plainness

Wilfrid Mellers

AARON COPLAND and VIVIAN PERLIS
Copland: 1900 through 1942
402pp. Faber. £18.50.
0 571 13380 0

Aaron Copland is a paradoxical composer—as most of the better ones tend to be, being of their nature concerned with contradictory realms of experience. He is "unique" in that "the Copland sound" is instantly recognizable; he is "representative" in being quintessentially American. There is no music which conveys the big-city experience more honestly than Copland's; which is more compassionately human to its acceptance of spiritual isolation while being responsive to the thoughts and feelings of average men and women; which attains, through tension, a deeper calm. In his music we can detect the neat, bland-eyed, rugged-souled early Americans of a Copley portrait, after they have lived through the physical and nervous stresses to which a machine age has subjected them. The big-city experience of the *Piano Variations* is "news that stays news", as startling today as when it first fluttered academic and socialist doves to 1930. The *Piano Sonata* of 1940 both nobly and tenderly relates that gritty austerity to the loneliness of the great American plains that Copland celebrated in his "popular" ballets and film scores. There's point in the fact that in his scores for *Of Mice and Men* and *Our Town* he produced perhaps the finest film music ever, honouring rural America by way of intelligent subservience to a mechanized medium.

In the introduction to this beautifully produced, lavishly illustrated halfway house in his autobiography Copland tells us that, as a man who has spent much of his life putting black dots on paper, he's suspicious of words about music. He is not prone to ratiocination and is not an "intellectual"; everything he has to say about life is witless or behind those dots. Even so, he has always known that one day he would write an autobiography, and kept diaries and preserved letters to that end. His justification is not any desire for self-aggrandizement, let alone self-exposure, but is rather a recognition that he has been a—one might say the—catalyst in the evolution of a distinctively American music. Born at the turn of the century, in "a drab street in Brooklyn" difficult to associate with the emergence of creative talent, he has become, through his music's Russian-Jewish, Negroid-Cowboy identity, the voice of America's polyethnic Plain Man. Because rather than in spite of its hybrid nature, Copland's music is plain, in its economical avoidance of fuss and fiddle; the man himself is plain—as this book testifies, both in the composer's own prose and in the interlarded comments of those who gravitated around him throughout this American century.

The book has an unusual structure. Copland embarked on it when he relinquished composition in the early 1970s. But his new career as a conductor left him no time seriously to tackle the task; only now that he has turned eighty are conditions ripe, largely because Vivian Perlis, as part of an oral history of American music projected at Yale, had taped a series of interviews with Copland during 1975 and 1976. These tapes, revised and expanded by Copland, form the core of the book, into which Vivian Perlis inserts connecting paragraphs of cultural history, and written or taped comments on Copland and the American scene by people who have known or been influenced by him—which means virtually everyone of musical consequence who has lived through his time and place.

Copland's narration is, as one might expect, self-effacing. He tells us nothing about his private life, except what we may glean; reading between the lines, from his behavior to public life in one way rather than another. Although he doesn't boast, he is proud of his triumphs; as well he might be, since his life, after an arduous start and the usual critical buffetings of his most toughly distinctive pieces, has been an archetypal American success story. He is sad that works like *Statements* and *Short Symphony* are comparatively little performed; yet is grumbled rather than disgruntled that his popular works, such as *El Salón México* and *Rodeo*, continue to afford pleasure, to nook premieres cannot be imagined, but perhaps even there love would conquer all.

thousands of people of the same ilk as those who stomped out of the *Piano Variations*, which he knew to be a key-work of our time. This makes sense, for the popular works, dealing with the same themes, display the same integrity as the unpopular ones; because the "serious" pieces display such moral fortitude, Copland can honour the common man's unthinking but not uncaring optimism with conviction. This book makes clear that the composer's search during the 1930s for a more accessible idiom was not a rejection of his past. It wasn't merely that he felt, as twentieth-century composers must, the forlorn absurdity of creating music that only a handful of like-minded people want to listen to; it was also an outcome of the politically critical atmosphere of the era. Although Copland himself was always an apolitical creature, he has been deeply aware of common humanity. His *Lincoln Portrait* may owe its multiple recordings to extramusical reasons, yet its opportunism involves profound emotional commitment. The music has "the Copland sound"; and when he creates a "big" symphony (his Third) in a style appropriate to the large concert-hall and its middlebrow public, he impressively displays the same qualities in a musically "abstract" work.

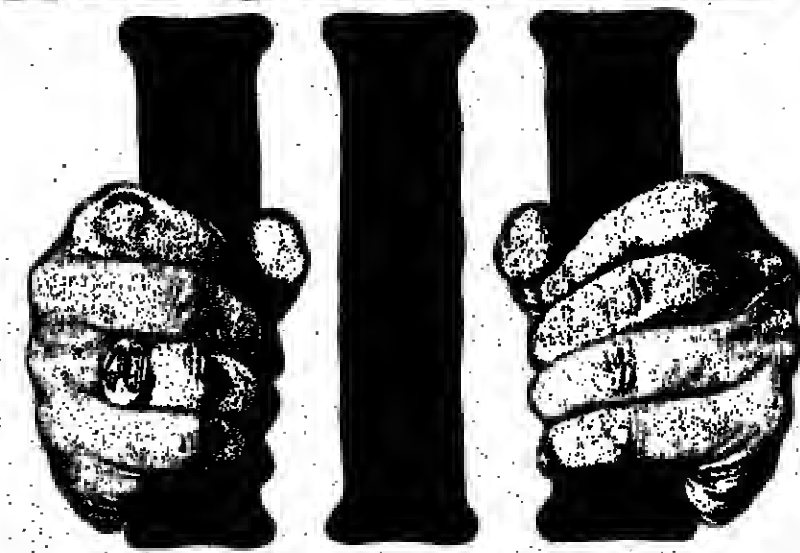
By itself, Copland's account of his professional career might be less than gripping,

however useful to the social historian. What makes the book fascinating is the interaction of Copland's sober but not sombre narration with the vividly immediate comments of his friends and colleagues. Since Copland has implied that his autobiography is his music, it is comforting to discover from these extra-personal glosses that the man and the music are indeed identical. Thus Virgil Thomson: "Aaron was president of young American music, and then middle-aged American music, because he had tact, good business sense about colleagues, and loyalty. Aaron made friends all over the world. He was always president of American music of any age or any place he happened to be." Marc Blitzstein: "Copland's lecturing, like his written criticism, is notable for a flat undecorated honesty. He is no felicitous phraser... and sometimes one stops listening. Almost always something important is missed." Most acutely perspicacious of the commentators is Leonard Bernstein, who remarks that Copland's playing of his *Piano Sonata* was bangy, but that was the way you had to play it. And it was delicate. Delicate was one of his moods, and harsh was another one; he's a great dualist, Aaron, almost in a Manichean way... I think that's because he was always in the middle. But when I say in the middle I mean able to see both sides. But not in a Hamlet-like way, in which seeing both sides tortures you inside. It's not that. It's that there's a total

good, total evil, and Aaron walks a true path of plainness. That's one of his biggest words—plain... Aaron was the most moderate man I've ever known, always ready to admit the possibility that there was a question about an opinion he held... That is not to say that he did not have inner passions. They seemed to go into his music, a rare combination of spontaneity and care.

Most of this may be confirmed by the experience of this reviewer. Copland may be less heroically multifarious in range than the long-neglected Charles Ives, and some would maintain that among living American composers he is less spiritually adventurous, as well as intellectually demanding, than Elliott Carter. Yet on balance the conventional estimate of him as the greatest living American composer is surely on the mark; and is so more rather than less because it is appreciable by a wide range of people common and uncommon. Harold Clurman, Copland's friend for more than sixty years, tells us that "Aaron was not complex. He was always just what you see. I have such a big admiration for him as a person. To me he's a great man." Given the identity between the man and the music, that makes him a great composer also; whose music will be "remembered", as he said he'd like to be, because it stood positively for life—that of all sorts and conditions of men, through circumstances not often propitious.

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THE OFFICE OF SPEAKER IN THE PARLIAMENTS OF THE COMMONWEALTH
274pp. Quillar Press. £19.50.
0907 621317

This is an original study of constitutional development. What Philip Lundy's book does for the first time is to identify and describe a broadening community of Speakers from all parts of the Commonwealth who now form an institution in their own right.

The parliamentary system will always rest on fragile foundations because it depends not on continuity of office but on eventual dissolution of the government in power. It is small wonder that those who support a government cannot contemplate the need to give way, eventually, to a government of their opponents. "Her Majesty's Opposition", as it is called in Britain, subtly indicates the temporary nature of its status, and the promise that Her Majesty will sooner or later welcome it back to favour.

At the heart of this system lies the speaker-ship, "the linchpin of the whole chariot". It is an uneasy role, because Speakers are chosen by, or at least must be acceptable to, the gov-

ernment of the day. In most Commonwealth countries, ministers do not appreciate a Speaker's need to gain the confidence of an opposition and to nurture its belief in the institution of parliament, to which governments themselves are at best half-hearted adherents. The development of the office of Speaker to the Commonwealth was long delayed by the executive authority's insistence on retaining all real power. The wisdom of Whitehall was held to be on a higher plane than that which had matured locally. As a result, colonial legislatures became resentful of external control, particularly when tactless or authoritarian governors were appointed as their presiding officers. When Speakers began to replace them, friction was inevitable. In 1700 in the Bahamas House of Assembly, an intemperate Speaker brought the butt of his pistol down upon the Governor's head, a gesture of protest which seems to have gone unpunished. As late as the 1950s, constitutional progress in West Africa had been so artificially retarded that a retired Clerk of the Commons from Westminster was appointed to preside over the Nigerian House of Representatives as its Speaker.

In the next decade, however, enlightenment came fast because certain Speakers decided to meet in informal collaboration at an overseas Speakers' conference. Three founder members of the movement were Speaker Lamoureux of the Canadian House of Commons, Speaker Dhillon of the Lok Sabha and Speaker King from Westminster.

The Commonwealth Speakers' Conference now meets on a regular basis. For some Speakers it is their only opportunity to ease the burden of loneliness and isolation which their office imposes, and to exchange information. The Singapore Speaker, for example, has to rule on terms used by Members in any of four official languages—English, Malay, Mandarin and Tamil; what is impracticable in one tongue may be quite acceptable in translation.

There are also interesting divergences in robes of office. In Australia when Labour is the governing party, the Speaker wears no robes. Wigs have been superceded in Malaysia by the traditional headdress, the songkok. Indian Speakers have no special uniform, yet at Westminster the daily charade of dressing up in eighteenth-century garments with full-bottomed wigs, although never adopted by its deputies in the Chair, is maintained somehow to assist the Speaker's prestige.

Bloomsbury Book Auctions

The second part of THE HIGHLY IMPORTANT COLLECTION

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From sequins to *monstre sacré*

Anne Duchêne

COLETTE
The Collected Stories
Edited by Robert Phelps
605pp. Secker and Warburg. £12.50.
043610502

This book contains one hundred stories by Colette, written between 1908 and 1945, and including some thirty not previously put into English. Perhaps it should be said at once, to dispel undue excitement among her many admirers who read her in translation, that these additions bring very little that is new and, with a few exceptions, only echo the pattern of similar stories written at the same time. The exceptions are of a kind to raise affectionate disturbance in the memory of readers already well versed in Colette. There are, for instance, four short sketches about "Clouk" – a young officer with an adenoidal problem which earned him his nickname until he was transmogrified into Chéri – and three about Chéri himself before he became the eponymous hero of the novel which many people see as the first work of Colette's maturity ("Clouk" is the first to see Léa, here). There is also a concluding story, "April", a slight but finely-sprung study of Phil and Vinca, who were to become the protagonists in *Le Bûche en herbe* and who always seem to have indulged in Colette – perhaps because of her own scandalous closeness to the story – a particularly spare, bleached style.

In the middle of the book there is also one new translation called "The Bitch", included because it deals, via dogginess, with human faithlessness, but the editor, Robert Phelps, has otherwise set his face against all the "dialogues des bêtes" on the grounds that they "constitute a genre unto themselves".

Phelps, an American, has previously compiled two books about Colette's life – one a "scrapbook", the other a gathering of her "lifetime writings" to compose an autobiography – which presumably explains why the jacket rather quaintly describes him as "well practised in the use of the scalpel". (The whole book is an American offset, and there are the usual tripwires for English readers in the translation as well as "hoofing it natch!" as a rendering of Parisian *belle époque* vernacular, and so on.) Most of the best stories are in translations by the late Antonia White and are as good as the task allows and as one might expect from a novelist of her calibre; most of the rest are in the diligent and very well-intentioned hands of Matthew Ward.

The editor points out very properly in his introduction that these are the "collected stories", not the complete stories, of Colette; and rightly acknowledges that a great many of them are not "stories" at all. He has divided them into four groups, which rather awkwardly confound chronology and content: "Early Stories"; "Backstage at the Music Hall"; "Varieties of Human Nature"; and "Love". This seems particularly unhandy, because he also in "A Note on the Text" distinguishes, rather liberally, four categories of "short story" in Colette's writings: what he calls *chroniques*, which may be reportage, portraits, reviews, and so on; autobiographical sketches, designed, and offered as such; what he calls "lyrical meditations"; and "short stories proper, with characters, a plot, conflict and resolution". He then

throws in the sponge by acknowledging that in Colette all these categories "tend to metamorphose into one another".

This is due, of course, to what he justly calls "the most imposing element in Colette's art: the use of herself", and the way in which this became part of her discipline rather than her self-indulgence (or of her nervous early dependence on herself once she had left Willy). It is her presence which gives the book what little unity it has. The pieces can be seen to mature and evolve with the writer's increasing sense of ease and mastery. Among the "Early Stories", one really has to include the music-hall vignettes too, which are on the whole fairly tawdry little sequinned bits and pieces, where the "commonplace poetry" Colette said she loved in the subject comes through in harshly sentimental line and colour; but the Clouk-Chéri studies have a much edgier, nervier promise, and one or two sketches from her lesbian period – "Sleepless Nights", and, translated for the first time, "Gray Days" and "The Last Fire" – are heavy with the sensuousness which she later brought under control. The next section, rather inane called "Varieties of Human Nature", is largely made up of the twenty-two efficient anecdotal stories – three translated for the first time, but it really doesn't make a scrap of difference – from *La Femme cachée*, written in the busy 1920s and 30s when Colette was keeping herself, in Claridges, by her pen; but broadens out as far as "The Rainy Moon", "Green Sealingwax" and the curiously tiresome "Stick Child". The stories in the last section, called, again rather meaninglessly, "Love" (as if that emotion were absent from the other sections) are almost all long, and are late work, in the magisterial and magical style of Colette's maturity: "Le Képi" is the finest, unless one prefers "Bella Vista", but in both, Colette's "use of herself" is beautifully and utterly assured.

None of these "stories", though, carries the weight of the "novels" which accompanied them over the same period (the inverted com-

mas because one remembers that Colette called *La Naissance du jour* a "novel", when it would seem to be a "lyrical meditation" if ever there was one). The editor ardently postulates that "even the slightest is *echt* Colette", and that "if the one called 'The Képi' is probably the least sentimental love story ever told, the one called 'April', about a teenaged Adam and Eve, is probably the truest". Hackles which stir at these absolutes will definitely rise a bit further on, when after a list of the kinds of people Colette writes about ("loners, lovers, liberated women, sexual outsiders, acrobats and mimes, children and adolescents, old maids and divorcees") he says that "to their needful lives Colette brings not only her classically trim art of storytelling but the canny, profoundly generous knowledge of all-too-human nature for which her name has become virtually a synonym". Later, he concludes that "it is the qualitative greatness of her example" – he has just said that in "Bella Vista" it is the progression of Colette's own reactions to the story "that – in the best sense – instructs us in the morality of being a neighbour" – "that makes it just and unforgiveable, exact and prescient [*sic*], to think of her, as Olenka Wescott once did, as 'a kind of female Montaigne', who wrote stories as well as essays".

Language like this suggests, as the kindest interpretation, that the editor is exhausted by his own enthusiasms: and of course that is the danger besetting all editors, biographers and commentators who fetch up on these shores. If, though, he has a rather cursory way with words, he has a downright unhelpful indifference to dates and figures. The ardent student of Colette, hot for certainties, will find it impossible to establish any correspondence between these stories and the rest of her life and work as he or she already knows it.

Dates are mentioned only in a closely-printed panel in smallish type on the verso of the title page; and deal only with the publication dates of the stories in book form. This can be confoundingly misleading. To take only the

first section, the Clouk-Chéri stories are attributed to *Mes Cahiers*, published in 1941, when even the most tentative student knows that Chéri appeared in 1920; the nugatory and conventional "Dialogues for One Voice" are ascribed to *Cantes de mille et un matins* of 1970, when they came from Colette's period as a journalist on *Le Matin* in the 1920s. *Les Villages de la vigne*, from which several of the stories in this section come, is dated as 1934, when it first appeared in *La Vie Parisienne* in 1908. And so on, through the book.

Well, OK, one hears the editor protest – he only wanted people to enjoy the stories, not to worry about their dates. Which is all very well, but there are several objections to it (sustained by visits to French book-shops at the moment, where the coffee-table Colette-industry is thriving). We all know that Colette helped to endorse the legend of her own life. We are all, by now, quite tired of studying the photographs: the young Madame Willy who does not want to meet the camera's eye, rapidly supplanted by the ex-Madame Willy, a preposterous postcard pin-up, lying about oenology like monstrous infant, and before long yielding to the aureoled *monstre sacré*, adrift on the raft of her arthritic bed, the kohled eyes gleaming with what we like to think of as tolerance and sympathy as well as a sardonic challenge.

And yet, because in spite of all these distractions we still find something excellent in much of the work, it is the more important that we attach her writings to some scheme independent of the titillating details of the life, and that we begin to evaluate the writing without the life, of which in the end we are going to grow terribly tired. We can never expect to bring the two together: Colette's greatest dignity lies, in fact, in what she did not say to make this more possible. But the process of learning to appreciate her writing is not helped by bringing us a great hugger-mugger, genial bundle of un-accounted-for writing, as this collection of her "stories" does.

Family feelings

Mary Kathleen Benet

MARIANNE WIGGINS
Separate Checks
271pp. Harvill. £8.95.
000271748
SUSAN KENNEY
In Another Country
163pp. Viking. £8.95.
0670394866

War and famine don't seem to be within the experience of the new generation of American women writers; pestilence (cancer, madness) and death (murder, suicide), however, are just their meat. These two books share not only this subject matter, but also a format: both are collections of stories about a family, united by the point of view of a single narrator.

Superficially this can seem to resolve many problems of construction, but in fact *Separate Checks*, the better of the two, is fatally unbalanced; we are led to expect that the female cousins in the hook will receive evan- handed treatment, but half the narrative is taken up by a single story, so that in the end we wonder who the book is about: Ellery McQueen, the taller (her mother was a mystery writer), or Aunt Belle, her favourite subject. Ellery is writing the stories as therapy after a nervous breakdown; she is trying to make sense of her family. Why are there no

meo in this family? "We ate them", she coolly replies; but most of the women here are excessively unliberal. The centrepiece, about Belle and Kit, is a sort of Marilyn Monroe-meets-Carlos Castaneda tale, and the heroine doesn't seem to mind that the hero's pet name for her is Bazooms. Finally his drinking and womanizing get out of hand and she shoots him, then kills herself in prison.

This is not the only lund tale. There is the triangle of Bella's dim mother, artist father, and lesbian stepmother; the coming of age of Cathy and Scooter, two cousins raised like sisters; the long-distance love affair of Millie and Hesh. We understand, after learning about Belle, why her baby Cathy is the most vulnerable of the cousins, the one "who, in a legion of the lost sex, is doubly lost". There is no story about Ellery, but one of the aunts craftily suggests that perhaps all the stories are really about Ellery.

The frame of the book is a luncheon to which Scooter invites them all to announce her engagement. The cousins' attachment to each other, and their nervousness about actually meeting, are well described; Scooter's brainlessness and the reactions of Iris's young children to their father's desertion are compelling. The writing is modern and knowing: Scooter's winsome look is her "Sandra Dee has moved her little bowels" expression. Characters pop up and disappear, but the ones we care about make it in the end, so that it's not really

Musical metaphors

Judith Chernack

RICHARD SENNETT
An Evening of Brahms
222pp. Faber. £9.95.
057113252

Richard Sennett is an American social critic, author of several studies of class and power. His second novel shows the qualities one would expect of his writing: thoughtfulness, detachment, analytic strength, precision of language. If his characters sometimes seem less real than the problems they represent, this may be the inevitable result of a deliberate choice of focus.

The problems here are those of young musicians struggling to perfect their art, and at the same time learning to come to terms with loss, failure, inadequacy. Indeed, *An Evening of Brahms* is that old-fashioned thing, a didactic novel about vocation and love.

He chose music which particularly demanded surrender, quietude and time with fragmented melodies, complex rhythms passed from voice to voice, unclear harmonic structures, music which meant little when each voice was played alone.

The reference is to the Brahms C minor Piano Quartet, but the words could also apply to the novel, and the relationships it depicts. Music, a "friendly art", provides metaphors for human relationship and growth: "touch", "tension", "connection", "learning to reach out".

Alexander Hoffman, cellist, little genius, only son of a left-wing Jewish family from Chicago, and Susan Flahds, talented pianist from a small town in Iowa, meet in New York as members of a student class on the Brahms quartet.

They go to bed, marry, and live together unhappily for three years, during which time Alexander's career takes off, and Susan withdraws into obsessive keyboard ornamentation. They are contemplating divorce when Susan dies after an accident for which Alexander is largely to blame. The fact that they are gifted artists gives their lives purpose and intensity, but seems to reinforce their isolation. The older figures who nurture and bribe them – Alexander's rich, doting businessman grandfather, a wise and melancholy Italian music teacher – are less ambitious for themselves, and so more generous and loving than the young. But they cannot save them; or even free them to become better artists.

The novel is framed by performances of works by Brahms (the great and good Johannes, it is implied, may be able to save and liberate, where ordinary mortals fail). A happy rehearsal of the Piano Quartet is balanced by a wild performance of the Brahms Requiem in which the ill-prepared and inexperienced

conductor, young Alexander, exorcizes his guilt and remorse for Susan's death. The final section provides the ultimate test of Sennett's novelistic experiment: to write intimately and at length about music; to recreate experience which is untranslatable, in the hope that it will be self-sufficient and self-explanatory. Earlier in the novel we have accounts of Alexander's discovery of cello vibrato, performances of Schumann's *Kinderszenen* and a Bach cello suite, a lecture on Schumann's madness and recurring allusions to Schumann's love for Clara and Clara's love for Brahms. The story of Alexander's musical education and his growth to manhood and self-knowledge takes on resonance from the musical themes which constitute his working life. But the musical dimension suggests a depth and passion which the characters themselves sometimes lack.

The account of the Requiem is sustained not only by the music, which some readers will no doubt bear mentally as it is being described and analysed, but the powerful language of the German text and its English translation. It is wonderful material, but threatens to swamp the "soiled, shabby, egotistic lives" of the participants. If Brahms and Clara are shadowy figures to us, Alexander and his dead wife are clearly drawn, but somewhat small and two-dimensional, in relation to the sublime music which carries their story along. The "fragmented melodies", "unclear harmonic structures", remain fragmented and unresolved at the end of the novel, though the author, wiser than his hero, offers a coda on the function of memory and time, and the power of music to heal – food for thought, if not for love.

William Golding: A critical heritage by Mark Kinkead-Weekes and Ian Gregor (292pp. Faber. Paperback, £3.50. 0 571 1325 6), which was first published in 1967, contains essays on *The Lord of the Flies*, *The Inheritors*, *Pincher Martin*, *Free Fall*, and *The Spire*. New material from Golding's work since 1967 (including *The Pyramids*, *Darkness Visible* and *Rites of Passage*) is contained in two new chapters, "Perspectives" and "The Later Golding", and the early chapters are unrevised. In a review of the first edition in the TLS of June 1, 1967 the authors' approach to the five novels was characterized thus: "they see the five as a completed phase of Golding's work; and they take as their task the elucidation of the texts. Elucidation is necessary, they say, because Golding's novels have been found obscure."

Doris Lessing's book referred to on p 1223 of last week's TLS is *The Diary of Jane Somers*. We regret the error in transmission. The book will be reviewed in a future issue of the TLS.

disturbing: we can callously say, as Ellery does on hearing of her mother's illness, "What is this, a Bette Davis movie?" Actually, with its references to the Kennedy assassination, old movies, pop songs and vintage cars, it's more like a game of Trivial Pursuit. There is one question, though, that even the most adept players would be hard put to it to answer: why does Wiggins insist on writing "w" for "with"? It is the only word treated in this shorthand fashion, and after a while you begin looking through the text alertly for any she has missed.

In *Another Country* is less trendy but in some ways more satisfying. Tragedy never hits heroine Sara, though it enters her house: she is the one who holds everything together, who comforts her children, feels responsible for her mad mother, guilty about not being there when her father had his fatal heart attack, and torn between the deathbeds of her husband and their dog, who seem to have identical careers.

The fashion for writing about divorce and hating your children seems, from the evidence of the both these books, to be on the wane, like the fashion for a Didion-esque lack of feeling. Children's misbehaviour is traced to family emotional crisis, and families are broken apart by external, not internal, forces. There is a longing for the home as a centre of values,

though in *Separate Checks* the warmest and most welcoming home is that of the priest who befriends Kit and Belle. The most disturbing aspect of Sara's mother's madness is that she aims against the home, breaking up the furniture and punching holes in the plaster walls – looking for what?

– Some sort of breakthrough.
– Is that a joke?
– Not necessarily.

But psychiatry doesn't loom large here either. People have to get through their lives with whatever wisdom they have managed to accumulate, and there are no short cuts. Religion is not the answer: it simply turns people into Jesus freaks and destroys tolerance. Shock treatment and drugs can re-route the train, but they can't construct whole new sections of railway. The only sources of forgiveness are other people, especially those to whom you are indissolubly connected. Marriage turns out, hearteningly, to be just as indissoluble as blood relationship, even if it isn't really marriage, as the woman on the beach explains to Belle:

"Oh, we're not married", Belle said.
"Well, you're living with your man, aren't you?"
"Yes."
"That's what it means."

Modern messiahs

Linda Taylor

CLARE BOYLAN
Last Resorts
183pp. Hamish Hamilton. £8.95.
024113709

"He is coming", says Melina, the Greek woman who yearly lets a cottage to Harriet on the island of Keptos, whenever a man connected with Harriet's family, or her own, is about to arrive on the ferry. The enigmatic statement (it is never clear who "He" is) has all the mysterious authority of John the Baptist's pronouncement about the coming of Christ. For Harriet (or so she thinks) needs to be saved – from herself and from her teenage children (Lulu, Tim and Kitty). But Roger, Lulu's boyfriend; Joe Fisher, Harriet's married lover; Martin, Harriet's ex-husband, and Stefan, the owner of the cottage, are false messiahs: they bring trouble for Harriet rather than taking hers away. Roger is a predatory scrounger; Joe is strong on ordinariness but weak on staying power; Martin is a moored autocrat who wants to re-organize his old family, and Stefan has plans to build a hotel, to bring "life" to sequestered Keptos. Faced with the prospect of family life and civilization, Harriet runs away with her paints (she is an artist).

Muddled, weak, liberal and honest, Harriet is a little person, adrift in a world of Brobdingnagian proportions; she is hemmed by her selfish children, by the seething lovelessness that surrounds her. Harriet is also culpable: "The life she had sought for herself was like the

one she prescribed for her beautiful doll – shelter and decay." And from the point of view of the oafs: "If you want to know", says Tim, "it's your fault . . . you've made our lives impossible . . . always asking were we happy." "You're a selfish snob", says Kitty. "You think you can wash away all the shit of the modern world if you do it with cold water at a stoic sink."

Like all incurable romantics, Harriet rejects the years of drudgery and harshness, escapes to a world that she can invent: Psiros, the pretty island across the sea, that, while the children were young, she had peopled with prince and princesses; Psiros, with its new Paradise Hotel and its guests whom she watches through a telescope. It is a paradise filled with thigh-stepping, tarted-up package tourists. But, like her the Batsys and the Janices are renegades; their cheerless disguises past and present pains. And, in paradise, at least, everyone is his or her own messiah – salvation is no longer an issue.

Clare Boylan's lively metaphoric prose is apt for depicting the painful realities of life. Like those Roman Catholic girls in her first novel *Holy Pictures*, Harriet sees the adult, "experienced" world as invasive and corrupt; she has to learn about solitariness, to learn, too, not to impose her ingenuousness on the grown-ups, especially "these new stained, stunned adults", her children. As her last last resort (beyond the messiahs, beyond Paradise, even), Harriet retreats to the hotel sand pit. ("For dust thou art, and unto dust thou shalt return".)

CHARLOTTE MEW AND HER FRIENDS

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Literary Review

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The November Issue

Ethics and exuberance

David Bradshaw

DENNIS HALL
Joyce Cary: A reappraisal
162pp. Macmillan. £20.
0333 310969
HAZARD ADAMS
Joyce Cary's Trilogies: Pursuit of the particular
real
280pp. Florida State University Press. \$20.
08130 07593

As far as Joyce Cary was concerned, critics were distinguished mainly for their sheer inveterate malice: "the good, the bad, the honest, the informed critics, will always hate and despise an original artist or writer". Elsewhere he likens them to the medieval scologist who classified a platypus as a bird because it laid eggs and then condemned it as a degenerate bird because it had no wings. Undeterred by this abuse, these two studies continue the ateady critical interest in Cary's own work which has developed since his death in 1957. Both books, however, claim to offer new approaches to the novels — a claim which is not really justified by either.

His contempt for their vocation apart, Cary shared the Anglo-American New Critics' awareness of how a writer's original intention may undergo significant changes during the process of composition, and Dennis Hall's reappraisal aims to show just how unreliable Cary is as a guide to the interpretation of his own novels. But while Cary's duplicity does not come as a great surprise, what is extraordinary is Hall's persistent emphasis on the almost schizoid division of his mind into the "thinker" of the expository books, essays and prefaces, and the "artist" whose fiction Hall considers a perverse rebuttal of this thought. Hall does rather weaken his case by further

suggesting that although Cary's speculative writings are quite discrete, a knowledge of them is nevertheless a valuable asset in interpreting the fiction. Similarly, he has no qualms in carding Cary's intentions and "conscious purposes" from the non-fiction. More damagingly, Hall's repeated observation that "the thinker and the artist are not in step", coupled with his inability to produce any convincing examples of this Jekyll-and-Hyde-like syndrome often provokes no more than unseasonal glimpses of the panto horse. For instance, in challenging Cary's assertion that he was writing about the atbical consequences of free will in his novels, Hall claims that, for all his harm exuberance, the eponymous Mr Johnson "at no time displays the characteristics of a free man". Why? Because Johnson is so clearly a drudge to his own caper-cutting biorhythms. Why? Because Cary has become too caught up in Johnson while describing him. This, Hall assures us, is "an instance of the artist contradicting the thinker". In deed his whole conception of the relation between fictional character and the reader is pretty run. "Cary requires his readers to hring to his works their own experience of life", he declares, and therefore feels certain that they will hray at anything incongruous with that experience. Thus Guiley Jinson, the protagonist of *The Horse's Mouth*, is unquestionably an allegorical character.

The idea of taking Guiley as a credible representation of a real human being is absurd. . . . In practice, we moderate the demands of our natures for all kinds of reasons — personal affection and the consequent willingness to benefit others at our own expense, for example. Guiley does not. In practice, we are not blessed with inexhaustible energy. Guiley is. In practice, no matter how strong our beliefs about the nature of things and in what we are doing, we are subject to periods of doubt and despondency. Guiley is not.

However, unlike us, but like Johnson, Guiley Jinson thrives on the quid of his chronically

lush imagination. Such a comparison between their bizarre antics and a notional, almost suburban reality seems a very odd perspective from which to write about them. For all their obvious difference, for all the occasional phoneyism of Cary's verbal hrio, the loony, brutal, ramshackle and demented worlds of Johnson and Jinson are surely nearer those of Waugh or Beckett than Bunyan.

So effectively does Hall disprove of Cary the sage, yet so niggardly is his praise of Cary the novelist, that the failure of this attempt to "remedy" the discontinuity between the "explanation" the thinker had to offer" and "what the novelist had to say" is almost inevitable. Hall's study often reads more like a rebuke than a reappraisal, his censoriousness complemented by an unfortunate weakness for preacherly asides.

Hazard Adams's book is altogether more fibrous, concentrating on Cary's two trilogies, *Herself Surprised*, *To Be A Pilgrim* and *The Horse's Mouth* (1941-44), and *Prisoner of Grace*, *Except The Lord and Not Honour More* (1952-55). The dual purpose of Professor Adams's study is to bring a greater "theoretical self-consciousness" to our view of Cary's trilogies and to recognize the "particular real" (as distinct from the conceptual, "abstract real" of the expositional work) which in his view makes them the novels they are. In doing so, Adams engages the ethical substance of Cary's work far more efficiently than Hall, even though it is never made entirely clear what this "particular real" is. We are told, however, that it is analogous to the pervasiveness of fate in Hardy or fog in *Bleak House*, but, unlike those two phenomena, it is hardly ever mentioned in the trilogies themselves. The "particular real" does not encompass the trilogies; we look through it to them.

The structure of the book is tripartite. Three lucid and valuable chapters in which Cary's philosophical and ethical beliefs are scrutinized in detail are followed by an extensive piece of "practical criticism" which accounts for the bulk of the book. Adams concludes with a section, couched, as he is quick to concede, "in a somewhat barbaric vocabulary",



which is "a renewal of a preface to reading by way of return to the abstract, but this time used of critical categories for the study of ficthe narrative". In its thoroughness and effort to instil some theoretical rigour into criticism of the trilogies, this book is to be welcomed, but in his choice of format Adams has created serious problems. After the gradually wearing "pursuit" through the close readings of the central section — a quest which is often more like a paper-chase, so elusive is the quarry — Adams's grammar of narrative, consisting of an "elevenfold conspectus of perspectives" through which wa are invited to constitute the texts, rather leaves the reader snuffing the air for a fugitive scent.

Both Hall and Adams feel Cary has been unjustly ignored and that his novels deserve to be read more widely. Yet with the exceptions of *Mr Johnson*, *Herself Surprised* and *The Horse's Mouth*, his work is unavailable in paperback editions. I am inclined to agree with the publishers.

Territorial wrongs

Christopher Hope

URSULA BARNETT
A Vision of Order: A study of black South African literature in English 1914-1980
336pp. Sinclair Browne. £15.
083300 007X

Ursula Barnett has written a readable, sympathetic account of black South African writing. Black people (and the term is used to include Indians and Coloureds and all those designated as non-whites by the government) have written in English since the middle of the last century, when they were encouraged by the missionary presses, and they have done so with ever growing enthusiasm. It can be said that they have been writing in English for almost as long as whites in South Africa. Why then the slightly unsettling subtitle of this work? A sign perhaps of a previous life as a doctoral thesis, but more than that it stems from the need to distinguish racial and linguistic territories. Lines of demarcation were ever a South African obsession. It is a disturbing suggestion that there exists such an entity as "Black South African Literature" which is to be studied as a thing apart.

Fortunately Dr Barnett's valuable examination of the literary history makes it clear that the emergence of new strains of black writing in South Africa has been from the beginning the result of close collaboration between writers, publishers, editors, magazines, missionaries and that at the heart of this collaboration has been a rich racial mixture. While there have been publishers, presses, magazines which foster and disseminate the works of black writers, there has never been an exclusive, racially based, black literary industry in the way, for instance, that there is an Afrikaans literary establishment dedicated to publishing Afrikaans writers for an Afrikaans readership. And just as well too, when one considers the tedious and the narrow range produced by that particular form of separate development.

Barnett is concerned to be kind but even more determined to be inclusive; the result is that *A Vision of Order*, with its excellent bibliography, is the fullest survey of black writing to emerge from South Africa and one cannot but be grateful. She takes in the full sweep of indigenous writing from the authors encouraged by the Revd R. H. W. Shepherd at Lovedale in the nineteenth century, to the astonishing achievements of Sol Plaatje and beyond, in the work of poets such as Oswald Mtshali and Wally Mongane Serote with whom began the extraordinary flowering of black poetry in the 1970s; and she is particularly discerning in her discussion of the achievements of novelists like Alex La Guma and Ezekiel Mphahlele. By dividing the field into poetry, the novel, short stories, autobiographical writing and criticism, she is able to show how certain forms dominate black literature; but this rather rigid framework means that other categories do not receive the attention they deserve. While the importance of magazines such as *Drum* is stressed, the important and original journalism it produced is not sufficiently examined; Anthony Sampson's own account of his editorship remains essential reading.

Although Barnett never underestimates the problems of the axiled writer and, banned books, a fuller discussion of the effects of censorship would have been welcome, since black writers have been most cruelly savaged. Banned writers may not be read or even quoted: exiled writers may not return, even to the form of their books. Black writers in South Africa may not revisit the works of certain older writers, nor are they free to browse among all of their contemporaries or subject their work to the critical discussion normal among colleagues. Under these circumstances black writers have had to be self-fertilising. It is a wonder any good writing has been produced at all, let alone the impressive harvest Ursula Barnett explores.

From blots to brilliance

Howard Erskine-Hill

MAYNARD MACK (Editor)
The Last and Greatest Art: Some unpublished poetical manuscripts of Alexander Pope
454pp. Associated University Presses. £36.
087413 183 9

And of myself too something must I say?
Take then this Verse, the labor of a Day;
And if it lives, it lives but to commend
The Man whose Heart has not forgot a Friend . . .
These lines, the probable opening of an epistle Pope once proposed to write to his friend William Cleland, help us to answer the question: what in practice did "The last and greatest Art, the Art to blot", to cancel or reject, mean to the author of that line? Other passages also clarify the issue:

While you y^e Presence to the Groves deny,
Our low's are faded, and our Brooks are dry;
The whining Herbs lay dying on the Plain,
At y^e Return they shall be green again.

— a pedestrian tribute at best! Take something more lively:

On Sufer's Neck his Arms here Autumn flings,
And naked Winters marry blooming Springs.

Or here is the end of a satiric dialogue:
Libels, & Ballads? Oh that point's agreed,
But moral Satire bringing vice to light
Such as the King would read, or Gibson write
Such as S^t Robert would present — "Indeed —
The case is alter'd; you may then proceed."
"In such a case, the plaintiff would be hissed
"My Lords the Judges laugh, & yourc dismissed."

"Lama stuff", Maynard Mack says of the first extract, though one might think that each is at least competently pedestrian. So often the verse takes flight at the next stage of composition. Thus the epistle to Cleland became the Epistle *To Arbuthnot*; the quoted lines were thrown out in favour of others well advanced in the draft, but on a notice that the final opening ("Shut, shut the door, good John! . . .") shares with the earlier first line its suddenness and directness. The idea of an abrupt opening (literally so since Pope arrived at it by tearing off the top of a page) had been tried out, and had transiently indulged that strong self-expressive impulse only found in Pope in his *Imitations of Horace*. Pope has here rejected the mediocre but there was something in it that pointed him in the right direction.

The second extract, submitted to William Walsh together with two sets of revisions, became with his approval:

Where'er you walk, fresh Gales shall fan you by Glade,
Trees, where you sit, all crowd into a Shade,
Where'er you tread . . .

— the marvellous lines from "Summer" in the *Pastorals* which Handel was to set when he incorporated them into his oratorio *Semete* (1744). No longer pedestrian, these lines turn walking into natural magic, and the drafts even

show how Pope and Walsh rejected a too-regular pattern of line-openings ("Winds, where you walk . . . Trees, where you sit . . . Flow'rs, where you tread . . .") etc) in favour of the final effect. The third extract was once in the early version of a celebrated passage on irrational imagination in *Dunciad* 1 (1729, 55-76). It is not without merit and Pope has used periphrastic well to depict a promiscuous coupling of the Four Seasons. Yet it is no more than a January and May idea, well known in human nature at least, and the leap of imagination from the last line to "And heavy harvests nod beneath the snow", at once more visual yet far out of nature, is quite breathtaking. What Pope blotted was a pointer to something far better.

Finally we see the early version of the end of the satire Pope addressed to Fortescue ("Horace, Sat II i, Imitated"). Here (save for one word) he has apparently reached his excellent final couplet in one and known it. But the sagged Creechlike Horace of "oh that point's agreed" had to give way to the shocked, poker-faced toos of "lawless things indeed!", a more lively effect, while the political references were improved by being made more general ("Such as a King might read, a Bishop write": lighter and more buoyant altogether). The cryptic autobiographical allusion to Walpole's having presented *The Dunciad* to George II was blotted likewise: better here to show the great man in full control of what was published than at the one moment he had been tricked by Pope.

With the publication of *The Last and Greatest Art*, critical investigation based on comparisons of this sort has a wide new field in which to range. Of Pope's major poems, his MSS of four have previously been edited in facsimile: the Washington University MS of *Windsor Forest* (1952) and the Bodleian MS of *An Essay on Criticism* (1962) by R. M. Schmitz; the Huntington MSS of the Epistle *To Bathurst* (1960) by E. R. Wassermann; while the copious *Essay on Man* MSS belonging to the Pierpont Morgan and Houghton Libraries were published for the Roxburgh Club in 1962 by Professor Mack himself.

The present volume adds the holograph and related MSS of the *Pastorals* and "Essay on Pastoral" circulated among friends and critics in 1709, together with the crucially important revisions sent to Walsh, and his replies; of the Ovidian translation *Sappho to Phaon*; the Epistles *To Jervas* and *To Burlington*; the satire originally addressed to Fortescue (Horace, *Sat II i*, Imitated), currently much discussed; and the Epistle *To Arbuthnot*. The *Essay on Man* MSS are now for the first time edited and presented in transcript as well as facsimile — an enormous task which would have warranted a book in itself. Finally and perhaps most excitingly the volume includes transcripts of the

record made by Jonathan Richardson junior of an early plan and rejected drafts of *The Dunciad*. No other major poetical MSS of Pope are now known to survive, save the *Homer* MSS in the British Library.

The interest of this material is too great to be adequately displayed in a review. It not only concerns the later stages of lines and passages, but that neglected subject: the structure of Pope's poems. Thus Pope's first impulse in the Cleland/Arbuthnot Epistle was to open with an affirmation of his qualities and qualifications to be a poet; his later and better decision was to lead straight into the more exasperating of the provocations he had had. In an admirable analysis of *To Burlington* Mack shows how late a decision it was to remove "Another Age shall see the Golden Ear . . ." from the poem's early pros and cons on landscape improvement to become the coda to the Timon Portrait and "a serene affirmation of nature's indwelling power over the long term to make good her losses — a confidence, always latent in the figure of laughing Ceres if taken seriously . . .". This decision had not been made when the poem first came out (though the MSS show the passage moving towards its final position) but only in *Works*, 1735. Now too, with the aid of transcripts, we can clearly see what Mack has previously pointed out concerning the evolution of *An Essay on Man*: how the image of the vine and the image of the stars pursue their pattern up and down the drafts until they are wedded in it at the end of Epistle III, instances of particular life commending the general conclusion.

If we look behind these moves of the shaping imagination we can also see here the earliest traces of familiar poems. Spence tells us that it was when Pope was ill with a fever, in January 1733, that Bolingbroke, at his bedside, observed how well Horace, *Sat II i* "hit" his case; "and in a few mornings" (said Pope) "I translated it and sent it to the press a weak or a fortnight later". On the back of the very doctor's prescription ("Please to take one of the Draughts going to Bed . . . For M^r Pope") are some of the earliest lines of the poem, e.g. "Heros & Statesmen read: but our Epistles / Of Good & Just & Fit, a Great Man whistles", among many fragments of lines. *An Essay on Man* often began with prose; as is well shown here.

In his copy of the 1736 *Dunciad* Richardson copied material for Book II which evidently pre-dates the earliest printed state of the poem. Opening with lines on the newly enthroned King Tibbald, it relapsed into a rough-cut prose schism which in due course was to become the basis of *Dunciad* IV, not written until the early 1740s. Universities, Inns of Court, travelling noblemen, virtuosos, Bentley's Cambridge, are all here. Clearly Book IV, which some feel to be ill-related to Books I-III, goes back to the earliest concep-

tions of the poem. Perhaps its idea needed the enthronement of some figure greater than a mock-laureate. In 1742 this was to be the God-dess Dulness herself. In Richardson's record numerous signs and allusions (and a suspicious disyllabic space for a name which cannot be Tibbald since that was freely written elsewhere on the same page) all suggest that at this early stage *Dunciad* II was to have had "Brunswick", George II himself, high on his "hed of state":

With Kingly joy he hears their loyal Lies
And sees his Subjects transport in their Eyes
His Strut, his Gait, and his dead Stare they praise
And gaping Crowds grow foolish as they gaze.

In its origins *The Dunciad* appears to have been more anti-Hanoverian, more clearly an ironic coronation poem, than we have been used to suppose.

The great interest of the material presented in *The Last and Greatest Art* takes precedence in a review, but cannot obscure the achievement of its editor and critic. Considering the amount of rigorous scholarly work in transcribing MSS of this complexity and in annotating them so scrupulously and helpfully, it is a small miracle that the critical discussion of the poetry should be so fresh, elegant, decisive and alive. Mack has never acquiesced in any real division between scholarship and criticism. This book is a real classic of both and no example for our time. It is his knowledge of what scholarship can demonstrate that cautions him from ill-out claims: there are complementary insights that criticism alone can provide. Thus, writing of *To Arbuthnot*, he negotiates the perannal frontier thus:

poetical MSS . . . cast little light on the questions of greatest interest. How, why, and when (for example) did Pope grasp the value of suspending his *apologia* between a command and a prayer? between a mood of partly comic exasperation and one of resignation, epitomized in the dying Arbuthnot? between images of elegy, exclusion and defense and images of domesticity, privacy, and family affection — the still centre that we all struggle to protect? How certainly did he understand that the shift to Arbuthnot was a stroke of genius, enabling him not only to pay tribute to his dying friend, but to make what Arnold will later call "this strange disease of modern life" a central theme: "a species of fractiousness illness that within the work of the poet's personae metaphorically shakes off in itself the remnant lines following the Sporus portrait, leading at last to an identification in spirit with his father, whose "life to sickness past unknown".

One need not go the whole way with the opening claim to realize that nobody has written or is likely to write about Pope better than that.

This book is handsomely produced. The standard of reproduction is generally high, though the *Pastorals* seem to have fared badly. It is very good value at the price, and its interest extends beyond the concern of professional scholars in the evidence and guidance it gives on all stages of the creative process of one of the indispensable poets of the English-speaking literary tradition.

Carretta has disappointingly little to say about the reasons that might lead us to think that these variations do indeed exist, and to value one writer or artist more than another. This unsureness is particularly noticeable in his treatment of the graphic material of the period. Many of the political prints reproduced in this volume are crude both in conception and execution: vomiting, defecation, coprophagy, and the application of enemas are their dress themes. Most of the prints are highly detailed, carrying lengthy captions or inset legends. The publishers have chosen to reproduce them in severely reduced form and in smoky half-tone: as a result, many simply cannot be properly read, even with the help of a powerful magnifying glass. Discrimination, in several senses of the word, is frustrated.

Lord Hervey's Memoirs, edited by Romney Sedgwick, is now available in paperback (278pp: Penguin. £4.95. 0 14 057015 2). The edition, first published in 1963, is an abbreviation of the 1931 edition which drew on the manuscript in the royal archives at Windsor. The Memoirs span the first ten years of the reign of George II (1727-60) and among the topics included here are "The Queen and Walpole", "Wives and Mistresses", "The Prince of Wales's £100,000", "The Princess's Accouchement", "The Separation of the Courts" and "The Death of the Queen".

Of wife and master

Michael Crowder

TOM HOPKINSON
Under the Tropic
307pp. Hutchinson. £9.95.
009 1561906

The second and concluding volume of Sir Tom Hopkinson's autobiography is mainly devoted to his years as editor of *Drum*, the Johannesburg-based magazine for blacks founded in 1951 by Jim Bailey. Its first editor, Anthony Sampson, told the story of his early years in that minor classic, likewise entitled *Drum*, which was reissued with a postscript and apilogue last year. Hopkinson, with a distinguished record as editor of *Picture Post*, was asked to take over the editorship of the magazine in 1958 after the abrupt resignation of Sampson's successor, Sylvester Stein, who had chosen for the front cover a picture of the black tennis player, Althea Gibson, kissing a white player. Bailey forbade its use as unnecessarily provocative to the South African government.

Hopkinson, who had earlier given advice to the magazine about its layout, took over a chaotic *Drum* office and produced, in Sampson's words, "a much more professional, and disciplined magazine with a more sensitive use of picture-journalism". Like his predecessor, he had a difficult path to tread with both the South African authorities and *Drum*'s owner. In the end it was difference of opinion with Jim Bailey that caused him to resign the editorship after only three years rather than the hazards of the increasingly oppressive attitude of the government towards a "free" black press.

Hopkinson stayed on for a while in South Africa as a freelance journalist before leaving for Nairobi in 1962 to found a training school for African journalists under the auspices of the International Press Institute. The four years he spent in Kenya are the focus of all but a few of the remaining pages of the book.

Effectively, then, this is an account of Hopkinson's eight years in Africa rather than the thirty-four years he has lived since he left *Picture Post*. He has already published various accounts of his African experience in his contribution to *The Best of Drum*, and in *In The Fiery Continent* and elsewhere. Much of *Under*

the Tropic covers the same ground and is more in the form of reportage than autobiography. There is little self-exploration, or examination of his relationships with others. The individual who stands out in these memoirs as having had an influence on his life is his third wife, Dorothy Kingsmill, and even then she merely seems to pop up at times of crisis to give him moral support in rather stilted and seemingly re-created conversation. Other than that, only the mysterious Avator Meher Baha is put forward by the author as having had a profound influence on him.

Shortly before leaving for South Africa, Dorothy took her husband to meet Baba in the Rubens Hotel. Sworn to silence since 1925, Baha, who was swathed in bandages from an accident which he had apparently predicted thirty years before; communicated with his devotees by passing his fingers over an alphabet board for his assistants to interpret. Asked by Baha whether he liked him, Hopkinson was so moved that he struggled to tell him, "I love you." Yet the reasons he felt that way and the declared subsequent impact of this silent Master on his life are never satisfactorily explained, even in the final few pages devoted to the post-African years when, in retirement, he and Dorothy set out to write their *Much Silence: The life and work of Meher Baha*.

If this book is of little interest as autobiography, it is fully worth reading for the exciting, sometimes brilliant, eyewitness accounts of events that have shaped the recent history of the African continent: Sharpeville, the Congo crisis and the first Nigerian coup d'état of 1966 among others. Perhaps most fascinating of all is his description of the *Drum* staff in Johannesburg listening "with mounting disappointment" to Macmillan's "wind of change" speech to the South African Parliament in Cape Town, a thousand miles away. When Macmillan finished, Cap. Themba merely "shrugged" and Ronnie Manyosi, the new editor of *Drum*'s sister paper, *Golden City Post*, just "turned away" from the radio. It was only when Dr Verwoerd, Macmillan's host, began his reply, "hesitating and audibly searching for words", that Hopkinson began to realize the true impact of "the speech we had not thought much of".

Pervasively political

Ian Donaldson

VINCENT CARRETTA
The Sparkling Muse: Verbal and visual satire from Pope to Churchill
290pp. University of Pennsylvania Press.
£23.75.
081227885 2

Why did satire achieve such heights in England under the ministry of Sir Robert Walpole, and why did it decline so abruptly after Walpole's fall from office? Vincent Carretta sets out to answer these questions in both political and historical terms. More than half of his book is concerned with the poetry of Pope, which he believes to be more deeply and pervasively political than is generally recognized. Carretta suggests, for example, that the Epistle *To Bathurst* was strategically published on the very day before Parliament reassembled in January 1733 in order to encourage Bathurst as he prepared to lead his attack upon the conduct of Pitt and present directors of the South Sea Company. Drawing his evidence from the pages of the Opposition Journal, *The Craftsman*, and from a host of contemporary prints, Carretta charts the nuances of political allusion in this epistle and in *Windsor Forest* and the *Imitations of Horace*. He suggests further that

the real theme of the *New Dunciad* is not the spread of literary corruption or abuses in education (which writers in *The Craftsman* had used as a metaphor for the political system of Britain), but rather the growth of a political tyranny that leaves the world in final darkness and disarray.

This kind of analysis, interesting as it may be, does not go very far towards answering the large questions that Carretta asks of himself. His second and more promising line of argument, however, concerns the relationship between satire and historiography in the eighteenth century. For Pope and his contemporaries, history was essentially a stable, uniform, and universal process, a series of recurrent and predictable events from which general laws of human conduct might be deduced. Such a view of history permitted a satirist to compare or conflate the events and dilemmas of his own time with those of the past ages, and to achieve a satisfying indirectness of approach: Walpole's fate might be hauntingly foretold by reference to that of Cardinal Wolsey, or the qualities of George II might be hinted at by reference to those of Augustus Caesar. Charges of libel addressed to Augustus Caesar were thus deflected, and satire seemingly invested with the force of general truth. The rise of historicism in the 1740s and 1750s, positing a view of history as a

series of unique and unrepeatable events, put paid (Carretta suggests) to this kind of satire. The weakness of a satirist such as Charles Churchill, he thinks, is attributable in large measure to the fact that the older view of history — along with the "emblematic" method that Carretta believes accompanied it — were no longer generally available at the time he wrote.

The explanation is not entirely satisfying. The idea of history that Carretta ascribes to Pope and his contemporaries had, after all, been around for a long time, and had underpinned the satire of Jonson, Dryden and many another satirist of earlier ages; to point to its acceptance during the Walpole years is not to explain why satire flourished precisely as it did just at that time. One may doubt further more that the achievement of individual satirists is to be accounted for in terms of the traditions which happened to be (or not to be) "available" to them at the time they wrote. It is unlikely that Charles Churchill would have been a greatly superior poet if historicism had never reared its head. "Individual genius must, of course be considered", Carretta declares dutifully at the outset of his study, but this is the very fact that his book has the greatest difficulty in coping with. In his search for political and historical explanations for the qualitative variations of eighteenth-century satire,

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In the nature of light

I. Bernard Cohen

ALAN E. SHAPIRO (Editor)
The Optical Papers of Isaac Newton
Volume I: The Optical Lectures 1670-1672
627pp. Cambridge University Press. £75.
0 521 25248 2

The genius of Isaac Newton was first revealed to his peers in 1672 with the publication (in the *Philosophical Transactions* of the Royal Society of London) of his famous paper containing a "New theory about light and colours". This is a landmark in the history of science. It is not only the first publication of Isaac Newton; it is also the first major scientific discovery to be published in the scientific journal - thus setting a mode of scientific communication that we have been following in the succeeding three centuries or so. The subsequent book incorporating these discoveries, the *Opticks* (1704), was easily the most popular of all the works published in Newton's lifetime. He personally supervised three editions in English (a fourth appeared in 1730, shortly after his death), as well as two separate editions in Latin. Furthermore, there was a first French version in 1720, followed by a revised edition in 1722; later on, in 1767, there appeared a wholly new French translation and edition made by none other than Jean-Paul Marat, *l'ami du peuple*.

It is a measure of the extraordinary brilliance of Newton's creative mind that he should have made his mark in three very different areas of science: mathematics (pure and applied), mechanics (including celestial dynamics), and optics. His mathematical achievement has been made accessible to us in the magnificent edition of his *Mathematical Papers* (in eight volumes, 1967-81), edited by D. T. Whiteside - easily the outstanding work of Newtonian scholarship, if not of the history of science as a whole, in the last decades. Many aspects of Newton's contributions to mechanics in general, and celestial mechanics in particular, have been made available to us in various editions and monographs, notably by A. Rupert Hall and C. C. Clairmont, and by J. L. Synge. But although there have been a number of articles and monographs on Newton's optical work, there has been no scholarly edition of his *Opticks*, the optical lectures which he gave at Cambridge University as part of his obligation as Lucasian Professor, nor of his optical manuscripts.

At long last, we are going to have a proper edition of the *Opticks*, prepared by Henry Guerlac, which is scheduled for publication in 1985, and now we have before us the first volume of a set of optical papers being edited by Alan Shapiro of the University of Minnesota; it deals with Newton's optical lectures in Cambridge during the years 1670-72.

The subject of optics connotes a series of "firsts" in Newton's career. Not only was his first published paper in this field, but - when he was appointed Lucasian Professor in the autumn of 1669 - he chose for the subject of his inaugural series of lectures the subject of refractive optics, including his new theory of colour. The twin topics of light and colour were very much in the air. In fact, Isaac Barrow, Newton's predecessor in the professorship, had published a work on this subject and had delivered a set of optical lectures as Professor in 1667 and 1668. Newton began his own lectures with a reference to those given by his predecessor, "not so long ago", which had brought together "a great variety of optical Optics and a vast quantity of discoveries". He also referred to the continued excitement aroused by the "recent invention of telescopes". This is of particular significance since Newton used his own discoveries in optics to invent a new kind of telescope, the reflector, an example of which was taken to the Royal Society, where it was "applauded", and was the immediate occasion for his being proposed as Fellow. It was, in fact, his election which stimulated him to send an account of his discoveries concerning light and colour to the Society, eventually to be published in his *Philosophical Transactions*.

Newton's discovery was nothing less than a solution to the age-old problem of why we see colours or why objects seem to have colours. Using an optical toy, a simple triangular prism,

he analysed sunlight and came up with the revolutionary claim that such light is heterogeneous, a mixture of light of different colours. By means of experiment and geometrical analysis, he showed how each of the colours has its own index of refraction or amount of bending as it goes from one medium such as air to another such as glass or water. The prism, according to Newton's theory, produces colours not by affecting the light, but merely by breaking up the mixture into its component parts, since each one is refracted or bent by a different angle. A conclusion is that the colours of objects arise both from the nature of the light by which they are illuminated and from their own properties of either reflecting and absorbing or transmitting light of only certain selected but well-defined colours. We may see an application of Newton's theory in the appearance of the blue sky. Because the atmospheric particles selectively reflect or "scatter" one type of colour rather than another, the light that comes to us from the sky has largely lost its reddish-yellowish-orange component and what is left is primarily blue.

An examination of Newton's lectures, coupled with the study of the contents of his notebooks and preliminary essays in optics, shows that his report to the Royal Society begins with an alleged chronology of discovery which does not fully fit the facts. As J. D. Lohne put it, Newton's embellished historical reconstruction made his discovery falsely appear to be a "Baconian induction from experiments". Newton's discoveries concerning the nature of light and colour led him, so he said, to the invention of the reflecting telescope. Because a prism, and also a lens, must by differential refraction break up the light it transmits into different

colours, it follows that a telescope lens or lens system made up of simple lenses must bring each colour to a focus at a somewhat different point. Hence, to avoid these chromatic effects, Newton introduced a magnifying mirror in place of a magnifying lens.

Newton's published paper on the subject, like his later book, was drawn from the material that he worked up in his lectures. Here is no popular presentation of a new scientific theory, but rather a treatise based upon ingeniously contrived and executed experiments and proofs. The lectures were delivered in Latin, and there exist two different versions, one that was preserved among Newton's private papers and the other deposited by him according to the statutes of his Professorship in the University Library. Accordingly, the assignment facing the editor was a most difficult one. He had to present a scholarly text that shows the relation between the two versions and enables the user to reconstruct from the printed text the separate portions. Professor Shapiro has done this and has also provided an English translation and a series of explanatory notes and running commentary. And, for scholars who are not especially interested in the details of Newton's development of the subjects, Shapiro has provided an extended summary, lecture by lecture.

This meticulously edited work is attractively printed by the Cambridge University Press, although the style and format no longer display the luxury of the same publisher's *Mathematical Papers* and *Principia* of a decade or more ago. The appearance of this inaugural scholarly edition of Newton's *Optical Lectures* is certainly a welcome event, but it will be even more



"Leonardo da Vinci's solar hair-dryer," purportedly discovered in a Tuscan convent together with drawings by Leonardo of an hydraulic butter churn, an expresso coffee machine which harnesses the steam from a volcano; a multiple-glow-worm-trap electric light-bulb; and a pneumatic tyre of trussed pig's bladders. It is reproduced from Carlsberg's *Objecta Invenit*: A catalogue of unfindable objects (126pp. Muller. £8.95. 0 584 95060 8).

exciting when Professor Shapiro produces the succeeding volumes, in which the treasures of Newton's private memoranda and research notes will be made public for the first time.

investigating. On questions relating to the fundamental constitution of matter, for example, the Epicureans engaged in sophisticated discussions and contributed new arguments to the debate between atomism and continuum theory. But in dealing with specific phenomena in the various branches of natural science their point of view was that once some explanation is available there is no need for the inquiry to be pursued further. Indeed if several explanations suggest themselves, all are to be entertained (the principle of "multiple explanations"), provided that, in that none is directly ruled out by the phenomena the principle of "no counter-witnessing".

Elizabeth Asmis's monograph is entitled *Epicurus' Scientific Method*, but this may be a tough misleading. The bulk of her study - all but six of the twenty chapters - is a discussion of Epicurus' epistemology and methodology in general, and her claims are that these are both more internally coherent, and more consistent with Epicurus' actual practice, than is generally acknowledged. On the first score she focuses on the two rules of inquiry, the need for initial concepts, and that for observation of the phenomena, and although there are some puzzling variations in her formulation of the thesis, her argument is that the initial concepts themselves are grounded in empirical observations. She offers on the whole judicious discussions of Epicurus' theory of perception and of the difficulties confronting his advocacy of the principle that all perceptions are true, explains and attempts to justify the rejection of demonstration and definition, and analyses what the Epicurean doctrine of signs owes to or shares with the views of contemporary or earlier thinkers.

But those readers who will look for a close study of Epicurean practice in scientific explanation will come away largely disappointed, for three main reasons. First, on the fundamental theories of Epicurean physics, such as the existence of atoms and the void and the infinity of the universe, the bid to argue that Epicurus is less influenced by the Eleatic background to this debate than by his own empirical methodology seems misguided. In some sense, to be sure, the concepts of being, not-being, limit and all may be said to be "empirically acquired". Yet the opposition between a rationalist, Eleatic method of inference and an empirical, Epicurean one is overdrawn and consideration of Epicurean justifications of

their positions diverts attention from and even masks the dialectical context of their original elaboration.

Second, on the ethical motivations of scientific inquiry in Epicurus Asmis argues lamely that others shared this point of view. This is at best true, but is no substitute for a detailed analysis of quite how ethical considerations influenced the particular scientific investigations undertaken and the results Epicurus obtained.

Third, and connectedly, the discipline of Epicurean practice in detailed scientific explanation is especially weak. Two chapters are devoted to "additional precision in the physical theories" and to "multiple explanations", and Asmis explicitly disclaims comprehensiveness in her treatment, while still putting it that the arguments selected are representative. Yet the first of these two chapters neither "clarifies" and its functions" nor the gods is a particularly promising topic on which to pursue the specifics of Epicurean physical theory. To protect Epicurus from the threat - which she exaggerates - of allowing different explanations for the same individual event, Asmis glosses multiple explanations as applying to classes of phenomena. But more importantly neither the strength nor the weaknesses of the principles are explored. Among the strengths may be said to be the resistance Epicurus showed to the dogmatic tendencies in most Greek natural scientific speculation, the over-confidence with which claims were made to have given the true explanation of obscure and complex phenomena. But among the weaknesses is the way the principle was applied indiscriminately both to such phenomena as lightning and thunder where a reluctance to dogmatize was sound policy, and to such others as eclipses and solstices where, on the contrary, adequate explanations had been proposed, in many cases decades before Epicurus, by competent astronomers. Here the stubbornness with which Epicurus and Lucretius persist in keeping in play the possibility that solstices are due to the winds, for instance, or to the sun running off of fuel, reveals the limitations of the principle applied universally to phenomena counted as obscure. Such a criticism of Epicurean methodology is not, to be sure, suggested from within the framework of Epicurean physics. But that is just to say that it is a weakness of Asmis's account to have stayed too closely within the confines of that framework.

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Irrational undercurrents

C. B. Schmitt

BRIAN VICKERS (Editor)
Occult and Scientific Mentalities in the
Renaissance
408pp. Cambridge University Press. £27.50.
0 521 25879 0

Until about twenty or twenty-five years ago it was generally taken for granted that there was little relationship between the rise of science in the sixteenth and seventeenth centuries and the magic which abounded in the same period. After all, modern science - characterized by Copernicus, Galileo, Bacon, Descartes and Newton - was then considered to be the child of reason, while magic was seen as an irrational carry-over of medieval superstition. In most of the historiography of the period a firm wedge was driven between the two as being of radically different intellectual traditions. If this meant that several problematic figures who unquestionably contributed to modern science - Paracelsus, Kepler, van Helmont - were also tinged by certain irrational elements, this was usually put aside with the explanation that they did not completely rise above the shortcomings of their age. As Brian Vickers points out in his introduction to *Occult and Scientific Mentalities in the Renaissance* it was only little over a generation ago that so distinguished a historian as Herbert Butterfield could completely dismiss as "tinctured with the kind of lunacy they set out to describe" those historians who gave a hearing to a figure such as van Helmont. By the mid-1960s things had begun to change when a series of scholars working principally in Italy and Great Britain started to argue two main theses. First, they showed that in several key figures of the Scientific Revolution there was more than a trace of interest in magic and occultism. Second, they produced evidence that these interests were not necessarily deleterious to the emergence of some of the key formulations of new science. Thus figures such as Bacon and Newton were re-evaluated in view of the new information with intriguing and important results. They were shown not to be the narrow positivists, innocent of religious and occultist knowledge and motives, which current historiography had held them to be. Moreover, a careful reading of certain fifteenth and sixteenth-century texts led scholars in the conclusion that some of the aims and aspirations - if not always the methods - of Renaissance Neoplatonists resembled and perhaps influenced key figures of the Scientific Revolution. The evidence they produced was based upon sound scholarship and hard-won information. This new information was partially integrated into the new writings on history of science.

Unfortunately, as frequently happens in such instances, the thrust of new information provoked a rather extreme reaction against the old positivistic interpretation. This struck home at the time of a general revolt against authority as characterized by the emergence of "student power". A general wave of criticism against traditional rational values became evident with a renewed interest in occultism, magic and astrology among students and others, both young and old. The result of this, among certain historians who focused upon the history of science, was an extremism which all but went over the edge. According to the interpretation which became increasingly prominent in the 1970s, magic and occultism went hand-in-hand with scientific work during the Renaissance and seventeenth century; the two were intimately intertwined, and the magical element was crucial in the emergence of modern science. Thus, the old interpretation, according to which science progressed only after it had become disassociated from magic, was turned on its head. For some of us it recalled the attempt of the 1940s by I. H. Randall to claim that modern science came not from the overthrow of Aristotle but from the Renaissance cultivation of Aristotle. As with all such revisionary attempts there was some truth in the claims. Yet, by the mid-1960s Francis Yates was arguing that "the Renaissance magic was the immediate ancestor of the seventeenth-century scientists". This hypothesis was nourished by much conjecture and by a single reference to pseudo-Hermes in

Copernicus's *De revolutionibus*, which can scarcely be considered more than a rhetorical device in a sober scientific work. Perhaps the highpoint of the Hermetic madness came in Alan Debus's *World's Who's Who in Science* (1968), where the entirely mythical Hermes Trismegistus was given a longer entry than many important figures of the history of science and Robert Fludd was allotted more space than Lavoisier and Dalton combined.

Yet, the real advances in the study of Renaissance occultism and pseudo-science by Garin, Pagel, Rossi, Yates, Walker, Vasoli, Zambelli, Copenhagen and others cannot easily be discounted. It is certainly clear in the case of Newton, as R. S. Westfall cogently argues, that we must now see him not only as a great mathematician, astronomer and physicist, but also as one who did much more than "dabble" in alchemy. Nor can we dismiss his theological and religious concerns as completely irrelevant to his science, though judiciousness is still called for. All in all I think students of the history of science have benefited from the assault upon the traditional approach, even if it has resulted in some extreme aberrations, not only by at times seeing magic as more significant than science, but also sometimes interpreting science as undifferentiated from other social activity. This overall muddying of the water has, however, resulted in a number of serious attempts to clarify the conceptual and historical issues involved. Above all it has increased the general awareness of several tendencies in early modern thought which had previously been largely neglected.

All of this is evident in the volume edited by Brian Vickers, which is an outgrowth of a meeting held in Zürich in 1982 at the Eidgenössische Technische Hochschule. The problem faced at that meeting (as the dust jacket tells us) was "To what extent did the occult 'sciences' (alchemy, astrology, numerology, and natural magic) contribute to the scientific revolution of the late Renaissance?" Among the participants were a number of those embroiled in the debates nearly from the beginning, as well as younger scholars well equipped to face the issues involved. Some of the papers break new ground by investigating in depth specific instances of the use of occultism by major thinkers of the sixteenth and seventeenth centuries (for example Marsenne, Kepler and Newton). Only a few appear somewhat misguided. One participant apparently believes that Pyro [sic] and Lucretius were "important figures of the occult tradition". Another author, treating England in isolation and forgetting about the revival of scepticism, can conclude "that there were no sharp discontinuities in mid-seventeenth century conceptions of the operation of reason and revelation". Such articles are rare in the collection, which can be recommended to all seriously interested in the subject.

A good deal of progress is made here in clarifying the science/occultism relationship, which has frequently been hopelessly muddled in the earlier literature. For example, Nicholas Chisole's argument that "occultism in the Renaissance was neither univariant nor coeval with hermeticism, but more various in content and pluralistic in its sources than is often recognized" should be heeded by all. Robert Westman, Judith Field and Edward Rosen help to clarify the particularly thorny problem of Kepler's precise position regarding occultism, while Ian Maclean's piece on Cardano and J. C. Sealliger makes a start towards understanding a key dispute of the sixteenth century.

Perhaps not all will agree with the conclusion reached in Vickers's substantial introduction, but it seems to me to establish a platform for future discussion: "The error, as I see it, lies in arguing that the occult sciences in the Renaissance were productive of ideas, theories, and techniques in the new science." While most interpreters now agree that one must consider seriously the occult tradition when studying early modern science, few would still take the extreme position which came to be known as the "Yates thesis" some years ago, though not the "Yates thesis" as such. What is still a live issue, however, is how "science" (as we now understand the term) emerged as a distinctive intellectual activity to become separable from philosophy and other disciplines. It is there that much remains to be done.

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Communications from the Cavendish

Jorge Calado

JOHN HENDRY (Editor)
Cambridge Physics in the Thirties
209pp. Adam Hilger. £17.50.
0852747616
JOHN HENDRY
The Creation of Quantum Mechanics and the
Bohr-Pauli Dialogue
177pp. Boston: D. Reidel. \$34.50.
902771648X

Against a background of economic depression and the stirrings of totalitarianism, physics flourished in Cambridge in the 1920s and early 30s, reaching its zenith in what has often been called the *onus mirabilis* of 1932. This was the year that saw the discovery of the neutron, the undeniable proof of the existence of antimatter in the shape of the positive electron and the splitting of the atom. These were soon followed by the achievement of nuclear fusion. As Massey observed, there had "never been a year in which so much of fundamental importance was discovered in one laboratory".

The book which John Hendry has now edited and introduced is a gathering of sorts, with many of the principal players called back to reminisce about their famous roles, or about the conditions that made possible such a congregation of talent and success. Some, like Blackett, Cockcroft and Chadwick, were even summoned from the beyond, their contributions lifted from recorded proceedings, lectures and reviews. The result is, nevertheless, a joyful and delightful celebration.

Nineteen outstanding physicists, many of them Nobel laureates and the overbearing majority Fellows of the Royal Society, lend themselves to this collective enterprise. The great absentee is the teacher or mentor of them all, the Cavendish Professor and director of the Laboratory, Ernest Rutherford. Already in 1922, Irving Langmuir could write: "After visiting many laboratories in England and the Continent, I became thoroughly convinced that the Cavendish Laboratory, not only for its scientific spirit but for the stimulating scientific spirit derived from its leader, stands far above all others." That spirit permeates the recollections of all those involved in *Cambridge Physics in the Thirties*. The story has been told many times (most recently in David Wilson's biography of Rutherford) but, like all good stories, it bears repetition.

The Cambridge of nuclear physics was also the Cambridge of Russell, Lewis and Keynes, but the physicists kept pretty much to themselves, working late hours, sometimes sleeping

in the laboratory or being woken up by "the Professor" at 3 am with the excitement of the latest discovery. The achievements were primarily experimental, but Fowler, Eddington and Dirac were also there. In those days the theoretical physicists belonged with mathematicians and were ensconced in their college rooms. It was only in 1926 that the teaching of mathematics was transferred from the colleges to the university, thus encouraging a stronger interaction between theory and experiment. Theorists and experimentalists were no longer segregated but could actually work under the same roof. As Rutherford's son-in-law, Fowler got a foothold in the Cavendish Laboratory (a room next door but one to Rutherford's) and kept everyone up-to-date on the latest theoretical developments.

The old Rutherfordian tradition of simplicity, jokingly defined as research conducted with string and sealing wax, suited the austerity of the times and may, in part, explain its success. Even Rutherford's most spectacular discoveries had been obtained with the crudest apparatuses, so he expected his people "to use the braids rather than the wallets". In the workshop, like Charon, stood the fierce-looking storekeeper, Lincoln, dispensing electric wire by the inch and rationing the supply of screws. Even the great Chadwick, the Cavendish's assistant director, acknowledged that he often wasted his time but not the laboratory's money. As Rutherford put it, "You cannot serve God and Mammon at the same time."

One regrets not having anything by the late Pyotr Kapitsa, still active at the inception of this book, but his ebullient genius is felt in many of the articles. The presence of C.T.R. Wilson is also strongly evoked—the inventor of the cloud-chamber which, as Ernest Wilson reminds us, was "the final word of appeal in matters of nuclear physics". Although he had a chair at the Cavendish, the shy Wilson preferred to work in the peace and quiet of the Solar Physics Observatory. His was a splendid case of a great mind finding inspiration in Nature. In true romantic fashion, for his scientific discoveries, as a keen mountain climber, he witnessed and admired the process of cloud formation and "the wonderful optical phenomena shown when the sun shone on the clouds", and these observations led him to study the physics of water condensation caused by air expansion, the working basis of the cloud chamber (radioactive radiation made visible by the formation of tiny water droplets along its ionizing path).

The contributions to *Cambridge Physics in the Thirties* vary in length and degree of specialization. Both Massey and Mott are very good at giving us a general idea of what was going on at the Cavendish around 1932. Wynn-Williams rightly concentrates on the electronics that made possible his scale-of-two counter which revolutionized high-speed counting techniques. Until then detection and counting of nuclei and nuclear particles relied on optional methods and the trusted eye of the observer, sight being the noblest and most accurate of the five senses. Lord Bowden is very perceptive and illuminating on the role of chance in scientific discovery—most of Rutherford's discoveries were made possible by a series of improbabilities, from the scintillating properties of zinc sulphide to C.T.R. Wilson's fondness for climbing the Scottish hills.

The shortest contribution comes, inevitably, from the relict of Dirac who, according to Peierls, "never engages in idle conversation". He writes about the discovery of the positron, an instance where theory was ahead of experiment. If Blackett had not been overcautious in the interpretation of his results, he could have been the first to publish evidence for the positron. Still, his work was, like that of Cockcroft and Walton on the splitting of the atom by following Gamow's tunnel effect theory, "a perfect marriage of experiment and theory". Likewise, Ellis could have been the first to confirm the existence of the neutrino, predicted by Pauli.

Theorists make much better speculators than do experimentalists—that is their freedom; but the world at large is never satisfied until the experimentalists prove the speculation to be true—this is their prerogative. However, as Chadwick once said, "It is much more difficult to say the first word on any subject, however obvious it may later appear, than

the last word."

Rutherford's deep belief in the essential truth of an experimental observation made him wary of elaborate theoretical speculations ("Reasons! Reasons! I feel it in my water!"). It is ironic that he should have congratulated Fermi on migrating from theoretical to experimental physics, for by the mid-1930s it was Fermi's group in Rome who, in John Hendry's words, was making the running in nuclear research. To paraphrase Norman Feather, in pioneering investigations, any school ultimately reaches the limit of its usefulness.

The 1920s was also a decade of great theoretical advances, and John Hendry's *The Creation of Quantum Mechanics and the Bohr-Pauli Dialogue* purports to show how the new kinematics of Heisenberg evolved and how, by 1927, quantum mechanics had received a definitive formulation and interpretation. This is, perhaps, the last great period of modern science to be extremely well documented through memoirs, autobiographies and correspondence. Scientists no longer write letters—they make long-distance phone-calls instead. Hendry seems, however, to have drowned in the amount of available material, and the result is a chunk of history obscured by microhistory (a trap which he carefully avoided in the other book). This is a work derived from his PhD thesis and it shows. The main arguments get lost in a sea of erudition and intrusive quotations. It is also as much a dialogue between Pauli and Bohr as a public arena for voicing, sometimes loudly, the convictions of the other major participants, like Born, Heisenberg, Schrödinger and Dirac, in the formulation of the new quantum mechanics. Although Hendry claims for Bohr the dominant role, he can't avoid turning Pauli into a kind of moral conscience of the new ideas, the uncompromising prophet of change. Pauli's youthful ardour led him to criticize the great mathematician Weyl, while still in his teens. He also went from castigating Heisenberg "because he is so unphilosophical, he pays no attention to clear presentation of the basic assumptions and their relationship to previous theories" to rambling with Born: "Yes, I know you are fond of tedious and complicated formalisms. You are only going to spoil Heisenberg's physical ideas by your futile mathematics." At another point Pauli threatens to retire to the field of beat conduction in solids, having no taste for the sort of physics in which truth is decided *a posteriori* by comparison with experiment.

One of the main problems of classical quantum theory, found, for example, in the Rutherford-Bohr model for the atom, with its electrons in non-radiative stationary orbits, was how to reconcile the discontinuities of quantum phenomena with the continuous nature of electromagnetic theory. For example, instantaneous transitions between stationary states were, for Slater, simply "quite silly". To physicists like Pauli it soon became obvious that the new mechanics not only called for a break in the laws of classical theory, but, more fundamentally, for a radical revision of the basic concepts. Bohr, however, saw no alternative to the classical concepts. Underlying this dilemma there was a time-honoured requirement that any physical situation had to be described by a visual picture—what has been called the visualization (*anschaulichkeit*) of a theory. Since the days of the doubting St Thomas people only seem to believe in what they can see, the kind of "despotism of the eye" which Coleridge denounced but which is enmeshed in our cognitive process.

The evolution of quantum theory, from the old hypothesis of Planck to the new kinematics of Heisenberg, is a long search for that visualization of what could replace it. At one point it seemed that the well-tested energy-momentum conservation would have to go, but Pauli kept asking for a reformulation of the concepts, arguing that in physics only quantities which are, in principle, observable (meaning, measurable) should be introduced. "It is not," he wrote, "the energy concept that is to be modified, but the concepts of motion and force." In his work on the anomalous Zeeman effect Pauli adopted a "purely phenomenological" description which "abandoned all use of models". Electrons could no longer be said to revolve around the nucleus in well-defined orbits. "We should not want to drag the atoms into the chains of our preconceptions," but

must, on the contrary, adjust our ideas to experience. . . . Even though the demand . . . for visualization is partly legitimate and healthy, this demand should still never count in certain set of concepts. When a new system of concepts is once clarified, then there will be also a new visualization."

It was Heisenberg who first established a quantum mechanics based on relations between observable quantities, but it was left to Born to formulate it in terms of matrices. Born himself tells us the story with great dramatic flair: "I began to ponder about his [Heisenberg's] symbol multiplication, and was soon so involved in it that I thought the whole day and could hardly sleep at night. . . . And one morning . . . I suddenly saw the light: Heisenberg's symbolic multiplication was nothing but the matrix calculus, well known to me since my student days." One should be careful, however, about taking this and other recollections at face value, for scientists, like actors, always have an eye on the audience for greater effect.

The next step came to 1926 with the wave mechanics of Schrödinger, praised by Pauli as having the generality of the Born formulation but without recourse to abstract mathematics. The wave-mechanical configuration of a system was now a superimposition of all kinematically possible configurations—"the system is, as it were, simultaneously in all kinematically conceivable positions, but not equally strongly in all of them". Born interpreted the presence of the wave as a kind of ghost field guiding the motion of particles, an idea which he borrowed from Einstein. The fusion of the two formulations (wave-mechanical and matrix-mechanical), once again inspired by Pauli, was accomplished by Dirac, Heisenberg and Born in Copenhagen, at the end of 1926; it remains one of the beauties of modern science.

Embedded in the new formulation is the Einsteinian conviction that it is the theory that decides what we can observe. In classical theory, physical interpretation of the symbols preceded mathematical formalism; now, in quantum theory, physical meaning arose from the mathematics. Ever since the "thought experiments" of Heisenberg the general public has understood why it is impossible to specify the position and velocity (momentum) of an atomic particle. This uncertainty only appears at the atomic level because space and time, in a way, statistical concepts, like the temperature and pressure of a gas. It is as meaningless to speak of the position and velocity of an atom, as it is to speak of its temperature. Heisenberg's uncertainty principle shows that quantum discontinuity imposes a restriction upon our observations, and this excludes the possibility of describing a physical situation by a mental picture. Visualization and visualizability, which were synonymous in classical physics, became incompatible in quantum theory. It was left to Bohr to put the final touch to Heisenberg's analysis, placing it on much firmer ground. It all amounted, once again, to the philosophical problem of the observer and the observed. As he remarked in his famous paper in *Nature* in 1928, "Our usual description of physical phenomena is based entirely on the idea that the phenomena concerned may be observed without disturbing them appreciably."

The quantum postulate implies that any observation of atomic phenomena will involve an interaction with the agency of observation; not to be neglected. "Since the definition of a state of a physical system demands the elimination of all external disturbances, and observation cannot be performed without some degree of perturbation being inflicted on the system, definition and observation also become incompatible in quantum physics." It was a far cry from 1900 when Planck introduced the concept of energy quantum to explain the energy radiated by hot bodies. As Heisenberg once said, "the picture changes over and over again, but it is nice to see how the picture changes."

Inner, Exile: Recollections of a Life with Werner Heisenberg, by Elisabeth Heisenberg (170pp. Boston: Birkhäuser. 0 8176 3146 1) is a translation by S. Cappellari and C. Morris of Elisabeth Heisenberg's account of her husband and, of their life under the Nazi regime. It was published in Germany in 1980 as *Das politische Leben eines Unpolitischen*.

The founding farmers

Don Rimmington

JOSEPH NEEDHAM and FRANCESCA BRAY
Science and Civilisation in China
Volume 6, part 2: Agriculture
724pp. Cambridge University Press. £50.
0521250765

Joseph Needham's erudite and encyclopaedic series of studies on Chinese science and civilization has been widely acknowledged as the most significant analysis of the Chinese world offered to Western readers. It has now reached the fascinating subject of agriculture.

This volume is the first in the series to be written by one of Dr Needham's collaborators, and Francesca Bray is to be congratulated on her scholarly clarity, which matches the standard set by the previous volumes. She has been faced with a vast array of textual sources—agricultural calendars, treatises, official compilations and monographs—written over a period of 2,000 years and often fraught with complex linguistic problems, and she has also had to consider a growing body of archaeological data. It is an indication of her meticulous methods and clearly defined purposes that, despite its inevitably compendious nature, her own agricultural treatise is a highly readable account. As she observes in her author's note, the bulk of her subject-matter is "appropriately down to earth".

The earth in question is that area, as big as Europe, which constitutes all of central and southern China. Excluded are the mountainous zones in the west and the steppes of Mongolia in the north. These central arable lands have been worked for thousands of years by sedentary farmers, who have been primarily concerned with crop cultivation and, unlike their European counterparts, only minimally with animal husbandry. All aspects of their labours are discussed here apart from water control and irrigation, which, perhaps unfortunately, have been dealt with earlier in the

series (Volume 4, part 3).

Observations that "where tillage begins other arts follow" and that "farmers are the founders of human civilisation" apply to most societies, but nowhere are they more appropriate than in China, which is, as Bray suggests, "the agrarian state par excellence". Confucius and other Chinese philosophers regarded agriculture as the basis of the country's wealth and the Legalists spoke of it as the "root" of all economic and military power. It is thought that the first taxes in China were levied on the land in the sixth century ac, and throughout the whole of the imperial period the revenue of the state was drawn largely from land taxes.

The origins of plant domestication in China are obscure and all the latest evidence is presented here. It can now be confidently asserted that as early as 5000 ac not only was dry-land millet cultivation being practised on the northern prairies of China, but wet-rice farming had also begun in river valleys in the south. Whether one of these two traditions spawned the other, or whether they are two separately developed systems of cultivation is impossible to say, but it is clear that for at least seven millennia there have been two distinct styles of agriculture in China. The distinction remains to this day.

Many modern observers of the Chinese scene, while recognizing the efficiency of its agriculture in the past, tend to emphasize the static nature of its rural society. They ignore the remarkable and continuing technological advances made in crop cultivation, first in north China and then in the south. These developments raised agriculture to the most sophisticated levels, and European agronomists were greatly impressed with Chinese technology when they first observed it in the eighteenth century.

Bray concentrates her analysis on these technical advances. She defines agriculture as technology, not a science, seeing it as "the technological system that mediates between nature and society". She restricts her account for the

most part to the "relations between agricultural systems and natural environment", since the social and economic arguments surrounding agriculture are to be dealt with in a later volume. This approach fits neatly with the copious Chinese sources, which provide uniquely detailed records of crops, cultivation and equipment, but which are notoriously less precise on questions of land tenure and farm management.

The technological history, which constitutes the bulk of the book, is consciously "arranged along the broad lines of the great Chinese agricultural treatises". It is divided into the three main topics of field systems, agricultural implements and techniques, and crop systems. Reference is made throughout to developments and conditions elsewhere in the world, and care is taken to distinguish between the dry and wet cultivation of north and south China.

This distinction is immediately and graphically apparent in the section on permanent fields. The narrow, rectangular plots, which are characteristic of the North China Plain, contrast vividly with the irregular small paddy fields in the south. For the cultivation of wet rice, the water supply is of overriding importance, and the size and shape of fields inevitably determined by natural conditions. On the question of the control of the water supply, the evidence seems to be that "even comparatively complex irrigation works, given favourable natural conditions, can be constructed and maintained by small autonomous groups" so that the necessity for extensive bureaucratic control is not as necessary as the proponents of the "hydraulic civilizations" theory suggest. The need to exploit all marginal land through the hard work and ingenuity of the Chinese farmers created the hillside terraced fields of north and south China, and by the end of the eighteenth century virtually all possible farming land had been brought under cultivation.

Bray explains in detail how from the earliest days the Chinese peasants developed and refined their tillage equipment, especially the

plough. By the Han period (206 ac – 220 ad), ploughs with curved metal mould-boards were in use, which could be pulled by no more than one or two draught animals. Ploughs like this were not developed in Europe till the eighteenth century, prior to which ploughs required six to eight animals. The wide range of tillage equipment available in China can almost certainly be explained by the desire to work the soil well before seeding. In the mixed arable-pastoral farming of Europe, where manure was plentiful and fallowing of land possible, there was less concern over the state of seedbeds.

Chinese sowing techniques are also shown to be far more elaborate than those in Europe. As early as Han times, Chinese farmers treated seeds with fertilizers and insecticides, a process only recently used in the West. The Chinese method not only ensured higher yields but also minimized the proportion of crop to be retained as seed grain. In north China, seed drills were used from Han times onwards and it was some sixteen centuries later before similar equipment was introduced in Europe. The Chinese farmer's careful approach to sowing can also be seen in the south, where the highly effective rice transplanting technique was perfected. This technique was complemented by equally labour-intensive hand weeding, but in the north farmers were already in medieval times using horse-hoes.

Chinese farmers have always used various forms of organic fertilizer. Given the relatively small number of animals on the land, an obvious way to preserve fertility was to use human manure or nightsoil. Bray acknowledges that "nightsoil immediately springs to mind when Chinese agriculture is mentioned", but she also cites evidence to show that its use must have contributed greatly to the retention of adequate levels of nitrogen, potassium and phosphorus in the soil.

In her discussion of harvesting techniques, she draws attention to the failure of Chinese farmers to develop any form of mechanical reaper, and suggests that it can probably be

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explained by a number of factors: the abundance of cheap labour throughout China, the practice of mixed-crop farming in the north, and the sheer difficulty of mechanized reaping of the irrigated land in the south.

Grain has always been the main element in the Chinese peasant's largely vegetarian diet. A survey carried out at the beginning of this century showed that 70 per cent of all arable land was devoted to cereals, with the rest divided between legumes (mainly soybean), oil seeds, fibre crops, tubers and roots, fruit and vegetables – the last two being only 1 per cent each. Earlier sources indicate that these proportions may not have changed substantially over the centuries. Bray traces the cultivation of millet, sorghum, maize and, later, wheat and barley in the north, and rice in the south. She draws attention to the introduction of the hardy, early ripening Champa rice strains from Annam in the eleventh century, which gave a significant boost to rice-production. The introduction of winter wheat in the north allowed for further extension of continuous cropping, which from Han times appears to have been well established in many areas. Density of population, which necessitated intensive farming methods, had ruled out fallow rotations as practised in the West.

Bray leaves her technology survey behind to consider whether the major advances made under the Han emperors constitute an agricultural revolution comparable with the European transformations from the seventeenth to the nineteenth centuries. Rejecting the idea that population pressure alone was the main factor, she contends that the emphasis of the early Han government on independent peasant production and created conditions for technological developments such as the seed-drill and metal mould-board ploughs. The manorial estates that grew up again later in the dynasty were able to use this technological base to develop sophisticated systems of commercial

farming. However the wars of subsequent centuries and the later shift of the economic centre southwards to the Yangtze area prevented the estates developing to the point where they were able to achieve "a permanent transformation of class relations".

The much discussed problems of why China did not experience a scientific revolution and why the roots of capitalism did not sprout is also tackled and a simple but thought-provoking agricultural explanation is offered. Under the Southern Sung new strains of rice were introduced and the area of cultivated land was expanded by a government under pressure from northern invaders. This "green revolution" produced unprecedented surpluses and commercial cropping was again possible, but the rapidly expanding economic activity seemed to consolidate rather than disrupt the relations of production. Bray's suggestion is that this relates to the nature of wet-rice farming itself. Work in the paddy-fields prospers through intensive labour by small production units, and it is still possible for production to rise more quickly than labour demand. Under these circumstances there is no incentive to consider economies of scale or technical innovations, and no need for radical change.

Bray takes a cautious view of the possible influence of Chinese agricultural technology on the European developments in the eighteenth century. It seems likely that European mechanized cultivation and sowing methods may have derived from Chinese ploughs, seed-drills etc, but the elaborate machinery which rapidly took shape in the West soon left the Chinese prototypes well behind. As Europe advanced, China declined, with no further expansion of agricultural land possible, the population rising and increasing pressure from abroad. With Western technology now flowing back into China, there is an obvious irony to be seen, and Ms Bray is left wondering "how many Chinese realise that the new and alien machines relate to their own heritage?"

The scholars and the zealots

Loren Graham

ALEXANDER VUCINICH
Empire of Knowledge: The Academy of Sciences of the USSR (1917-1970)
484pp. University of California Press. £23.95.
0520048717

The organization of Soviet science is based on a paradox: in the 1920s the radical Bolsheviks who vowed to present Europe with a totally new form of society decided to base their science on a monarchical institution, the Academy of Sciences founded in the eighteenth century by Peter the Great. The Bolsheviks did not follow the path of the Jacobins in the French Revolution, who abolished the Académie des Sciences after denouncing it as a useless vestige of aristocratic privilege. Nor did they agree with the pattern of research emerging in Western Europe and North America, where by the early twentieth century the universities had thoroughly displaced the old academies as the foci of advanced research. Instead, they created a new pattern based on an ancient institution, and by the beginning of the Second World War the Soviet Union was the only country in Europe where the best science was being performed in an Academy of Sciences. Today, that institution, the Academy of Sciences of the USSR, together with its affiliated academies in the various republics, is a vast organization of several hundred research institutions and tens of thousands of researchers. It may well be the most important single scientific institution in the world, since in other countries the best scientific talent is dispersed over a much greater variety of institutions and faculties.

How and why did this happen? As Alexander Vucinich shows us in his excellent book, *Empire of Knowledge*, it was not a simple linear evolution. The old Academy in Petrograd (Leningrad) attracted criticism from mili-

tant Bolsheviks as hostile as any that Jean Paul Morut and the Jacobins had levelled at the Académie des Sciences. Several prominent Bolsheviks called for the Academy's abolition. Dozens of personnel were purged, including a few full members of the Academy who disappeared forever. But throughout this time of terror the Soviet government continued to expand the Academy system, pumping a larger portion of its national income into science than any other nation in the world.

One reason that the Soviet Academy did not suffer the same fate as the French is that the two revolutions were based on dramatically different conceptions of the proper relationship between science and government: the French revolutionaries were revolting against centralized monarchical organizations in accordance with an ideology that favoured economic free trade and rejected self-propagating and guild-like academies; the Russian revolutionaries were also rebelling against monarchy, but they were doing so in accordance with an ideology that favoured centralized economic planning. The Bolsheviks early recognized that they needed a pre-eminent scientific organization to match their system of economic planning; the idea of a centralized Academy was not repugnant to them, only the particular political views held by the members of the Russian Academy, most of whom had favoured the liberal political parties soon outlawed by the Soviet government. For over ten years after the Russian Revolution, no member of the Academy was also a member of the Communist Party. The important questions of the time were whether its politically unreliable members could gradually be converted or replaced. In the end both questions were answered positively, although as late as 1941 only 5 per cent of the members of the Academy were members of the Communist Party. Today almost seventy per cent of the full and corresponding members belong to the Party.

Even after the Academy had been incorporated into the Soviet system the history of its relationship with the government was uneven and troubled. One of the most difficult periods came in the 1940s and early 50s, a time which Vucinich calls "The Triumph of Ideology", when the intellectual content of science itself was affected by dogmatic interpretations of Marxism. Only in genetics did a pseudo-scientist, Trofim Lysenko, manage to gain control of the whole discipline, but Stalinist ideologues made unsuccessful attempts to win domination of many other fields, relativity physics, quantum mechanics, physiological psychology, astronomy and structural chemistry.

Vucinich has described this dramatic story as a "conflict between the scientists, as the guardians of scientific legacy, and the philosophers, as defenders of ideology". While this interpretation has some validity, the actual story was not that simple. It is worth noticing that the worst threats to Soviet science in the late 1940s and early 50s did not come from professional philosophers, but from third-rate scientists who tried to win Stalin's favour. These people included Lysenko in genetics, G. V. Chelintsev in chemistry, A. A. Maksimov, and R. I. Shteynman in physics and O. B. Lepeshinskiy in cytology. These persons were criticized by both scientists and philosophers whenever political conditions permitted. It was a struggle, crossing these academic lines on both sides, between genuine scholars on the one hand and ignorant careerists and ideological zealots on the other.

Eventually the nightmare of Stalinism ended, and Soviet scientists in the Academy sought more freedom in the thaw of the late 1950s and 60s. The physical scientists enjoyed great prestige because of the successful atomic and space programmes and were therefore able to help their less influential colleagues in the biological sciences to throw off the vestiges of Lysenkoism. The physicists, mathematicians and chemists pushed through a series of reorganizations of the Academy that demoted the stature of the engineers and applied scientists, who had been favoured under Stalin.

In the last chapters Vucinich describes the strengths and achievements of the Academy during the post-Stalinist years. He has given us the first English-language history of this remarkable institution, a history which he aptly describes in his final sentence as "the most part admirable".

The Islamic connection

Lynn White Jr

DONALD HILL
A History of Engineering in Classical and Medieval Times
263pp. Croom Helm. £18.95.
0709912099

Donald Hill's new book deserves a wide and thoughtful readership. In a non-polemical, almost reticent way he is trying, on the basis of very recent scholarship, to convince people on both sides of the North Atlantic who consider themselves knowledgeable, that two of the axioms imprinted on their minds by a defective education are no longer tenable. He proposes substitutes that should prove sturdier.

The first of these obsolete views is based on the perdurable aristocratic Platonic tradition that contrasts theory with practice and puts a maximum value on abstract thinking at the expense of doing. For over 2,000 years priority in admiration has been given to pure thought. The Two-Societies debate, however, becomes ever more polemic as our world becomes more egalitarian. Historically, technology started earlier than science and at any given point was normally more elaborated than most contemporary science. Indeed, there was remarkably little input of scientific theory to engineering before the nineteenth century. The long-delayed reunion of hand and head largely accounts for the unprecedented development of both technology and science since then. However, just as hand and head are parts of one organism but operate in quite different ways, so the history of engineering is an independent discipline, neither a subsection of the history of science, nor a footnote to the history of economics or sociology. Hill is a true humanist: "Waterclocks" he writes,

are of crucial importance in the history of mechanical engineering... This is not meant to imply, however, that machines should be considered only in their relation to an evolutionary process, but also as satisfying creations in their own right. The mechanical clock is still an interesting, important (and often beautiful) machine, even though now it is being superseded by electronic machines. Such is Hill's "minor", but culturally pregnant, thesis.

Hill's "major" thesis – and this is the core of his book – is related to the first, but is different in totality. It flatly challenges the still dominant pattern interpreting Western history: the Greeks; the Romans; then a confused thousand years consisting of those decadent Byzantine years dared to call themselves Romans (and whom Gibbon disliked because they so pervasively declined to decline and fall for a millennium after his schedule demanded it), and the unintelligible Muslims whom Richard I fought so valiantly, and in the West a rough-and-tumble of rather vulgar Germanic invaders who precipitated the Dark Ages but who, after all, can't have been all bad, since many of us today are descended from them; then the liberation of Europe from medieval darkness by the Renaissance; after that the Enlightenment; and now us.

It is Hill's intensive study of the Islamic part of the Mithmash Millennium, and particularly its technology, that has led him to see major defects in this pattern. His basic education was in engineering, and throughout his adult years he has worked full time in that profession. As a young man laying pipelines in Syria, however, he learned Arabic and was fortunate to marry a Palestinian Christian lady of cultivation, perception and humour. On returning to England, he spent nights and weekends in Arabic studies, finally earning a PhD at the University of London under the guidance of Bernard Lewis. He then plunged into the almost entirely unexplored history of medieval Arabic technology.

His first great achievement (1974) was a splendidly clear annotated translation of the unpublished treatise on mechanical devices, completed in 1206 by al-Jazari, an expert in machine design. To judge by the manuscripts, it was the most popular machine book of the Islamic Middle Ages. Five years later (1979), thanks to the emergence in Istanbul of a manuscript more complete than any then known, Hill was able to do the same for the three Banū Mūsā brothers' collective treatise on pneumatic and hydraulic devices which greatly expanded the Hellenistic tradition in that art.

The Banū Mūsā were themselves learned in both Greek science and technology and did much in the Baghdad of the first half of the ninth century to encourage Arabic translations of Greek texts. Unfortunately, on grounds of expense, Hill's publisher refused to include his edited Arabic texts in either the al-Jazari or the Banū Mūsā annotated translation. As is inevitable in our post-colonial world, some Muslim scholars in Islam are resentful that a Frankish infidel has seized the initiative in opening up a significant but neglected aspect of "their" culture. It is a tribute to Hill, however, that in 1979 a very competent historian at the newly established Institute for the Study of Arabic Science in Aleppo published al-Jazari's text for the first time. May that of the Banū Mūsā follow!

Islam, from Morocco to Java, is replete with large libraries of Arabic manuscripts, many of which are only very partially catalogued. A great deal remains to be learned. Hill himself has searched some European collections. In Florence he saw and analysed for the first time a badly damaged manuscript of an unknown machine book written in Muslim Spain in the eleventh century by an unidentified technologist named al-Murādī. The diagrams clearly show both segmental and epicyclic gears. Al-Jazari used segmental gears, but in Western Europe no gear trains comparable to al-Murādī's are found before Giovanni de' Dondi's famous clock (1384-64). Considering the constant contacts of the Italian cities with Islam, the diffusion of these types of gears to Western Europe may be safely assumed.

Diffusion, however, was often slow, primarily, I believe, because the training of engineers was a process of apprenticeship without systematic study of any wide range of technology. Yet it is very curious that both in Islam and in the West the application of waterpower to industries other than milling grain seems to start about the same time: our first present evidence of hydraulic fulling-mills in Islam comes from Iran in 1107, whereas they are found in Northern France by 1087; our first mention of a waterpowered sawmill for cutting lumber in Islam is from the first half of the twelfth century, but no such engine has emerged in the West before 1204 in Normandy. We still have much to learn about the operative relations between Islam and the medieval West. Yet this small book offers hard evidence that Islam provided an essential link in the chain of continuity between Hellenistic engineers and the technologists of our own time.

Stellar scrutiny

Colin A. Ronan

RONALDO G. GIOVANELLI
Secrets of the Sun
116pp. Cambridge University Press. £11.95.
05212521X
DAVID MALIN and PAUL MURDIN
Colours of the Stars
196pp. Cambridge University Press. £13.95.
052125714X

With *Secrets of the Sun* the late Ronald G. Giovanelli, a noted solar physicist working in Australia, intended to reach as wide a readership as possible. The public pay for solar research and have a right to be told of its achievements and its problems, or so Dr Giovanelli believed. Few would argue with him. However, the dedicated research-worker often faces difficulties when he tries to communicate his ideas to others, and it is a measure of his dedication that Giovanelli was able to write a book which manages not only to describe the sun in the light of modern research but also gives good reasons for carrying out this research in the first place: he also indicates where future studies may be expected to go.

But Giovanelli did not successfully overcome all the hurdles in writing for the non-specialist. Here and there the reader is led to assume to have knowledge of some fundamental physics that may in fact be quite unfamiliar; again the units used will not always be those to which a non-specialist is accustomed. Moreover, some terms creep in which are com-

The Grand Schemer

Frances Stewart

BARBARA WOOD
Alias Papa: A life of Fritz Schumacher
394pp. Cape. £10.95.
0224020021

Alias Papa is a biography of Fritz Schumacher, author of *Small is Beautiful*, originator and guru of the Intermediate Technology movement. It is by his eldest daughter, and written, like many of the best biographies, with love, not detachment. The story is a fascinating one, not only because Schumacher was an original, creative and influential thinker, and a charismatic man, but also because his life provides a commentary on the turbulent years in which he lived.

He was born the son of a professor of economics in Bonn in 1911. Wartime food shortages in Germany were so acute that Fritz had to rest on his way home from violin lessons in 1917, because he was so hungry; after the war the children of this middle-class family were sent to a camp by the Red Cross to combat malnutrition. After school in Berlin, he attended University in Bonn, where he reported to his sister: "Tennis – you must admit – is more important than anything." But intellectual pursuits actually dominated. He secured a Rhodes Scholarship to Oxford and subsequently spent time in the United States, returning to Germany in 1934.

The attitudes of an apparently "liberal" academic family in Germany in the 1930s are illustrated by the history of the Schumachers. Fritz's father wrote to his eldest son in 1933: "First of all one has no choice. Secondly, the Fatherland demands that we wholeheartedly support the good forces that are at work, and that are, to a certain extent, personified in Hitler." Professor Schumacher urged his children to join young Nazi groups and the SA. Fritz alone resisted; he left Germany for England in 1936. It seems probable that the time spent outside Germany in the early 1930s helped him to develop a more critical perspective than that of the rest of his family, whose attitude was typical of middle-class Germans.

Throughout his life, Schumacher was quintessentially an intellectual always seeking the truth, challenging orthodoxies and arousing turmoil in the process. His search led to a succession of Grand Schemes. The first, in 1935, was designed to cure unemployment. He suggested that the state should pay everyone a minimum wage to be financed by a turnover

mon currency among solar physicists but out to the world at large. Perhaps if Giovanelli had lived we should have been treated to a glossary: he would, presumably, have provided an index as well. All the same, this is a book which can be recommended and which, with its excellent illustrations, many in colour, will surely appeal strongly to all amateur astronomers; it should appeal also to those professionals whose work lies elsewhere than in solar research.

David Malin and Paul Mordin's *Colours of the Stars* will appeal to a wide readership. The subject is unusually interesting because the stars' colouring is subtle and in most cases not obvious to the eye. Why this is so is explained in the first chapter, which is followed by an account of the photographic techniques available to the astronomer to make this colour readily visible and, incidentally, gives some historical background to colour photography, including a fascinating account of the good fortune which attended James Clark Maxwell's demonstration of the process in 1861. After these basic preliminaries, the rest of the book explains the results of the application of the various techniques. The photographs are breathtaking and, with its large format (22cm x 28cm), *Colours of the Stars* can be enjoyed for them alone. Yet this is more than a glorious picture book; it contains information that has never been better explained, and much material that is quite new in a book intended for the general reader. There are also included two appendices which contain some details of photographic techniques, put there, as David Malin says, *pour encourager les autres*.

tax, while employers would top up this minimum. Schumacher, then twenty-four, was enormously enthusiastic about the scheme, but his father and uncle opposed it, disliking the state interference involved. Yet, like many of Schumacher's ideas, this was essentially non-interventionist, laying down new rules, but leaving decisions to decentralized firms. Despite major changes in beliefs throughout his life, this scheme has much in common with later ones: it is immensely simple; it challenges conventional views to such an extent that it is automatically rejected by all "soud" men, like his own relations. Yet, when one thinks about it, it is very difficult to see why it shouldn't work far better than orthodox solutions.

The next Grand Scheme was developed in the early 1940s. Schumacher was convinced that conflict between nations would be reduced if an international clearing union were instituted. He developed the scheme while working as a farm labourer as an alien in wartime Britain. It eventually came to the attention of his hero, Keynes, who found it excellent, but discouraged publication on the grounds that he (Keynes) was "working at some proposals of my own... I think my own plan goes further than yours... and it would be a pity to get discussion and criticism moving along different lines." Eventually Schumacher decided to publish, but Keynes's plan, which was to form the basis of the Bretton Woods discussions, was published a month before his.

After the war, Schumacher worked for twenty years as Economic Adviser at the National Coal Board. There he was among the first to foresee the energy crisis. He also became convinced of the destructive and short-lived nature of development based on non-renewable forms of energy.

It is already certain beyond any possibility of doubt that the "Oil-Coal-Metal Economics" cannot be anything else but a short based abnormally in the history of mankind – because they are based on non-renewable resources and because being purely materialistic, they recognise no limits... here [nuclear energy] man is entering a territory which, to all who have eyes to see, bears the warning sign "Keep Out".

A trip to Burma in 1955, together with extensive reading, had led to a near dramatic conversion in attitude and belief. Fritz Schumacher had been a vehement anti-Christian. Now he came to accept religious values, first adopting a Buddhist philosophy, but ultimately becoming a Roman Catholic. Simultaneously, he developed the ideas of what he called "Buddhist economics" or "economics as if people mattered". It was from this perspective, deeply influenced by Gandhi, that he developed the philosophy of intermediate technology, where he has been most influential.

After visiting India, he identified a vast technology gap: the great masses of the poor were left with traditional technology with very low productivity, while modern technology, because it was so expensive per workplace, could only provide high productivity jobs for a small minority. Intermediate Technology would raise the productivity of the poor at a cost they could afford, while fitting their capacities and the ecology and meeting basic needs. Eager and capable friends, notably Julia Porter and George McRobie, helped to encapsulate these ideas in institutional form in the Intermediate Technology Development Group, which is the nearest (apart from eight beautiful children who adorn the photos in the present book) to a living embodiment of Schumacher.

Sadly, most people are too conventional for Fritz Schumacher; while the power of economic interests is too strong to be overturned by ideas alone. Most of his ideas have remained lost causes, with strong minority support. But the problems he identified are still with us, and his solutions remain relevant.

This excellent book skillfully traces the life and ideas of a man who, with characteristic arrogance and charm, summed up his own achievements: "I've always wanted to measure myself against the great men, so-called, of this world. The result is quite satisfactory, as far as it goes. But my God, against the problems of this world we are all as a bunch of children."

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Defining human purpose

Jerome B. Grieder

JAMES REEVE PUSEY
China and Charles Darwin
544pp. Harvard University Press. £22.
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Standing at the threshold of power in the summer of 1949, Mao Tse-tung summarized the lesson to be drawn from the approaching victory of the People's Liberation Army: "Classes struggle, some classes triumph, others are eliminated. Such is history, such is the history of civilization for thousands of years."

The language is, after a fashion, Marxist; but Mao's inspiration clearly owes as much to Charles Darwin and Herbert Spencer as to Karl Marx. Indeed, in the first decades of the twentieth century Darwin-Spencer had a more immediate, pervasive and, perhaps, a more enduring influence on Chinese intellectuals and would-be revolutionaries than did Marx-Engels. The Chinese came to Marxism only slowly. It took the drama of the Russian revolutions of 1917, and considerable Leninist elaboration of the original doctrine of proletarian internationalism, and finally concrete Communist intervention in the organization of the Chinese revolutionary movement to persuade Chinese radicals that Communism offered a message relevant to their needs and aspirations. And even then, for those of Mao's generation at least, vestiges of an earlier historical vision persisted.

For Darwinism, had spoken directly and forcefully to Chinese coming of age in the anxious years before and after the turn of the century. China's experience in the nineteenth century amply confirmed that the struggle for survival and the extinction of the unfit are in fact the way of the world in relations among nations and cultures. And, as orthodox historiography no longer could, Darwinism rendered understandable – however unpalatable – the bleak prospect that loomed before the Chinese in the century then beginning.

How the Chinese understood Darwinist ideas, and the nature of the influence that these

ideas had on the course of China's modern transformation, are questions often raised by historians, but hitherto abstractly examined only in Benjamin Schwartz's now classic meditations on the intellectual world of Yen Fu, the celebrated first-generation translator of Huxley, Spencer, J. S. Mill and Jevons. The long-awaited publication of James Reeve Pusey's *China and Charles Darwin* is thus a welcome event.

Mr Pusey gives us, for the first time, a comprehensive, richly detailed and carefully structured narrative and analysis of the impact that Darwinism had, as a category of understanding and explanation, on the diverse minds and personalities that were responsible for the creation of a revolutionary culture in China in the two decades preceding the collapse of the Ch'ing dynasty in 1911. Although in intellectual style too subtle and too thoughtfully nuanced to be praised merely as a first venture on to new ground, this is a pioneering study.

Pusey's stage is spacious; his cast of characters is numerous, various and colourful; his story, though not without its moments of humour, is one of high seriousness, and properly so. Darwinism was the medium in which Chinese intellectuals, bereft of certainty and self-confidence, reappraised the fundamental assumptions that justify belief and action; the relationship between the claims of the individual and the needs of the group; the essence of nationhood; the sense of time and history; the balance between natural design and human purpose.

The major actors are already familiar. Liang Chi-ch'ao, the great purveyor of Western ideas to a Chinese audience at the turn of the century, emerges as the principal protagonist. But there is also Kang Yu-wei, the eccentric Confucian progressive who was Liang's first master; Yen Fu, the intellectual radical and cultural conservative; Sun Yat-sen, Chiang Ping-lin and other anti-Manchu, quasi-republican revolutionaries; dissipated congregations of self-styled anarchists in Paris, Tokyo and Shanghai. By focusing our attention on a particular cluster of ideas, Pusey is able to show us even such well-known figures from unfamiliar

and revealing angles. His discussion of Liang Chi-ch'ao's early venture into anti-establishment journalism, the *Shih-wu pao*, brings vividly to life the issues that lay in the background of the "Hundred Days" reforms in 1898. His patient exploration of the ways in which a Darwinist argument informed the ensuing debate on such broad and ominous topics as imperialism, racism and the significance of the inherited culture, contributes greatly to an appreciation of the intellectual substance that lay behind China's faltering first steps in pursuit of a timely and "fit" political order.

It soon becomes clear that there were about as many "Darwinisms" in China as there were self-proclaimed "Darwinists". There was a culturally radical Darwinism, and a culturally conservative Darwinism; a rationalist Darwinism and a mystical Darwinism; an anarchist Darwinism and a statist Darwinism; a revolutionary Darwinism and an anti-revolutionary Darwinism. They had more in common, however, than the appearance of chaos would suggest. In one way or another, reason was found in Darwinism to subordinate the claims of the individual to those of the group – defined variously as nation or culture or class. Darwinism inspired not a despairing resignation to progress measured in eons and eons, but a high-hearted confidence in the possibility – indeed, the necessity – of human intervention in the processes of political, social and cultural evolution. And Darwinists started from, or in the end came to, a faith in the inspiring prospect of human moral evolution as lying at the heart of the matter – a reaffirmation, in its way, of inherited Confucian confidence in the perfectibility of human nature.

"Darwin justified revolution", Pusey says. "Darwin created the ideological vacuum that cried out for something like Marxism, and he established the criterion for what that something should be." Henceforth anyone who wishes to view from within the fears and the expectations that have driven the Chinese revolution forward could do no better than start by reading this sympathetic, imaginative and thoughtful book.

Handwritten note in Chinese:

此書係由
美國紐約
郵政局寄
出，其內
附有美國
郵票，故
不另收費。
（譯者：張
其成）

Remainders

Eric Korn

Charles Darwin is at his most approachable when he is giving way to enthusiasms: exploring with grave delight the "exhaustless fertility of Nature in the production of diverse yet constant forms" of barnacles, living or fossil, recounting with astonished precision the craftsmanship of orchids or of earthworms, or, best of all, describing, as naturalist rather than biologist or theoretician, the curious behaviour patterns of the Darwin domestic animals or the Darwin infants.

Those hooks of Darwin's that gave the least theological offence have been the least popular. The works on barnacles, though they remain essential references for any balaenologist (or do I mean cirripodist?), were out of print from the 1850s to the 1960s; *The Formation of Vegetable Mould through the Action of Earthworms* ran through thirty impressions in its first thirty years, but not at all during the next thirty; his orchid book (*On the various contrivances by which British and foreign orchids are fertilized by insects, and on the good effects of intercrossing*) was last printed in 1904, except for a facsimile edition, no longer available, of the sixth American impression of the second edition; and the *Biographical Sketch of an Infant*, where, in the course of a dozen delightful pages, the doting but clear-sighted parent managed to adumbrate the chief lines of the next century of research in developmental psychology, was for nearly three-quarters of that century obtainable only in Armenian or Russian, although, to be honest, I doubt if the Armenian edition (Yerevan 1914) was at all widely available for very long.

The Expression of the Emotions in Man and Animals has not been quite so neglected, having been sporadically reissued, but the critical and bibliographic esteem it commands have both oscillated. Sober-sided Darwinists have been a trifle sheepish about it, perhaps because it shamelessly exudes wonder and enjoyment, and because it is based not upon any serious scientific experiments, but upon the casual observation (it is a great source of comfort and stimulus to dog-owners) and also upon the responses to the wonderfully absurd questionnaire ("Does shame excite a blush when the colour of the skin allows it to be visible: and especially how low down the body does the blush extend?") which Darwin had printed and circulated among missionaries, anthropologists, tropical surgeons and others into whose purview a dusty blush might properly fall. The originals of these questionnaires are hugely rare. Quoting Deane whose capture brings to collector or book-collector hundreds of brownie points (readily convertible into currency); but they have been reprinted (Freeman and Gauthy, *Bull Brit Mus Nat Hist* [hist series] 4, 1972) as well as in the *Expressions* itself, where anyone can enjoy Darwin's idiosyncratic common sense: "15) Can guilt or self or jealous expressions be recognized? though I know not how these can be defined." 16) Is the head nodded vertically in affirmation and shaken laterally in negation?"

The queries were propounded because Darwin thought it important, for the purposes of evolutionary theory, to ascertain "whether the same expressions and gestures prevail, as has often been asserted without much evidence, with all the races of mankind, especially those who have associated but little with Europeans." Of necessity, Darwin took evidence at second hand, but not uncritically. "General remarks on expression are of comparatively little value, and memory is so deceptive that I earnestly beg it may not be trusted." The same scruple led him to insist that the illustrations of the diverse expressions should be those now celebrated heliotype photographs by Otto Rejlander and others, the howling infants displaying what Lavater called Simple Bodily Pain; the young lady disdainfully "supposed to be tearing up the photograph of a despised lover"; the withdrawn gentleman (perhaps Rejlander himself) simulating disgust ("A sneer of food on a man's beard," muses Darwin, "looks disgusting, though there is of course nothing disgusting in the soup itself"); and the horrible electrical rigors in the faces of M. Duchenne de Boulogne's paralyzed madmen.

Expression of Emotions is crisscrossed with curious anecdotes (monkeys close their eyes when given snuff), with happy observations from Shakespeare, Lady Mary Wortley Montagu, Rajah Brooke, and Sutton, the observant keeper at Regent's Park, and with striking imagery: "I remember seeing a man utterly prostrated by prolonged and severe exertion during a very hot day, and a bystander compared his eyes to those of a boiled codfish"; but it is the photographs which excite hookpersons. At 7,000 copies it is much the commonest Darwin first edition; but demand, and consequently price, rose abruptly when it came to be thought of as a sort of photographic incunabula (which it never was).

Things grew more interesting when Darwin's hiliographer detected two distinct issues of the first edition, differing in minor but unmistakable points concerning the arrangement of preliminary and final leaves, differences of setting, punctuation and capitalization. (Does Agony have a capital A on the list of illustrations? Is there a comma or a full-stop after the word "portrait" in the advertisements? Has an inverted comma fallen on page 617? Priority was easily established, all the differences pointing towards increased clarity and consistency with the Murray house style. There were already two states of the plates, presumably because the masters wore out and had to be replaced. The more obsessively one compared the two variants, the more differences emerged: but they stayed remorselessly trivial, so I was always rather ashamed about the whole business when it emerged, as it frequently did, in the course of salestalk: "Of course, it is quite vital that a discerning collector like Sir should have the first issue as it first sprang from the press. Now, while the alterations between what we professionals call Froeman 1141 and Freeman 1142 are not momentous, quite erm the reverse actually, erm, you don't really want an example, well for instance on page 59 there is a drawing of 'Cat in an affectionate frame of mind, by Mr Wood' and in what we take to be the second issue it says 'Cat in an affectionate frame of mind. By Mr Wood', I'll write it down shall I? So you know that it's the drawing, not the cat that's by Mr Wood. And on page ten 'expounder' gets a hyphen, and on page 208 of the second issue there is a brand new misprint 'that' for 'that'."

The more one goes on in this strain, the more one is convinced that this is not a fitting activity for a full-grown lad or one in possession of a moiety of one's marbles. Sometimes I would ramble defiantly on, about collecting as an exercise in pure style or stylish purism, about the properly pious collector and his proper platonic love of the Platonic first issue or prototype, even if there were no visible mark to distinguish it from a later issue; only a crude logical positivist would settle for less. It is what the eye doesn't see that the heart grieves after. Trivial types were only the outward and visible sign (or signs) of an inward and spiritual difference (or difference), even though it may be a zero difference. The words take on an entirely new significance in a new historical context, as Borges understood.

If there are two impressions, the tone of the passage alters, even if the words remain the same: what the author first merely proposed has now *reasserting*, with all that implies.

And at length I would offer the corrupt lure of some possible meaningful Textual Variation, on some as yet unscanned page. For the true devotee this is of course just a rationalization, like saying that you eat fish on Fridays because the body needs additional protamine phosphate at the weekend.

But rationalization or no, there are two significant textual alterations I have just spotted, a small victory in the unending battle against common sense.

On page 104 of the first issue Darwin observed, apropos of inflicting the body to excite fear in the face, and the Pabie of the Ox and the Frog, that, according to Mr. Hensleigh Wedgwood, the word *laet* expresses, in all the languages of Europe, the habit of yawning. In the second and all subsequent issues this reads: "In several of the languages of Europe, some one in the meanwhile having told Darwin, or maybe Wedgwood, that the generalization didn't hold for Basque or Finnish.

And on page 307 of the second issue two toes of a footnote are reamputated, and several lines of text reave, to remove a reference to Henry

leigh Wedgwood's assertion that the sounds of horrified expiration, like *ugh* and *uh* and *ugh*, gave rise to many words like "ugly" and "huge". Hensleigh Wedgwood, author of the *Dictionary of English Etymology* (2nd edition 1872) was simultaneously Darwin's first cousin and his brother-in-law. *DNB* speaks of him as "displaying an extraordinary command of linguistic material and great natural sagacity, marred by an imperfect acquaintance with the discoveries of philological science", which is pretty comprehensively damning for a philologist. In August 1872 Darwin was correcting proofs at Leith Hill Place, the home of another of his Wedgwood cousins, Hensleigh's brother Josiah. Hensleigh might well have been in a privileged position to make last-minute corrections. But it was just a vacillation, for in *Contested Etymologies* (1882), a critique of his superseder Skeat, he has returned to the *ugly-huge* hypothesis. He scorns Skeat's derivation of *huge* from Old High German *orihjon* as "far fetched"; on the other hand "the pedigree from the interjection of shuddering—*ugh*!—and the connection with Scandinavian forms like *leel*, *uggo* and the corresponding *E. ug*, *ugge* to feel a repugnance to, an abhorrence of (Halliwell), remains unimpugned". Personally, I can't take sides, except to doubt the sensitivity of anyone who can use *ugge*, *repugnance* and *unimpugned* in the same sentence. There's a lot more about Swedish dialectal *hugg*-do and Wedgwood signs off with an Anglo-Norman *lago* commercial:

Out une biere merveilleuse
E laide e ahoje e hideuse.

These seem to have been the only published changes in *Expression of the Emotions* in Darwin's lifetime. The first edition (both issues together) of 7,000 copies was published in November 5, 267 of these were taken up at Mr Murray's autumn sale. A further 2,000 were printed at the end of the year, dated 1873 and described as "tenth thousand" on the title; they resemble the second issue, except for a further rearrangement of plates. This impression had unfortunate consequences: it sold so slowly that there was no call for a new edition until after Darwin's death, and his revision did not appear until 1890, edited by his son Francis.

This is dull enough as far as it goes, but it may not be the whole story by any means. I've looked at painfully few copies, and must examine more. I've prepared a little questionnaire of my own for any reader who owns either 1872 issue.

Another curious bit of microdarwinian, perhaps less trivial. In *The Descent of Man* Darwin gives the wrong date for *Hereditary Genius*, the *magnum opus* of his other kinsman, Francis Galton. He gives it once, correctly, as 1869 and then four times in succession as 1870 (there was no 1870 edition). This mistake occurs in the first edition of *The Descent* (1871) and has never been corrected. Might Darwin have had some unconscious reason for confusing these dates? He might indeed.

Hereditary Genius was published in late 1869, and immediately on its appearance Darwin wrote to congratulate Galton in the most enthusiastic terms. (Francis Darwin dates the letter December 1870, but this is certainly wrong. Galton's equally enthusiastic reply does bear a date.) Galton was emboldened to undertake a series of rather clumsy experi-

ments on transfusing blood among rabbits to test Darwin's pangenesis theory. He kept Darwin informed of the results, and must have thought that his methodology had Darwin's support. He published a paper, suggesting that his results seemed to argue against the theory, in March 1871, just after the appearance of a refutation in *Nature* the following month that suggested that Galton had misunderstood his theory and his experiments were not a crucial test (and therefore, by implication, a waste of time). Darwin seems, for once, to have been less than straightforward, though Galton was correcting proofs in January 1871, by chance having had conscience about Galton's activities in 1870? Bizarrely, in the second edition of *Variation of Animals and Plants* (1875) he attributes his own *Nature* paper to Galton, confusing its date with that of Galton's reply to it.

Well, even Froude made mistakes. Ralph Colp is a wise and scholarly psychiatrist and Darwinian (he may practise Darwinian analysis, which would be alarming) who has written on the unconscious determinants of Darwin's ill-health (*To Be an Invalid*). He has also had a major part in unravelling the origins of a curious hit of modern folklore, the myth of the Darwin-Marx letter, in which, allegedly, Charles thanks Karl for his kind thoughts, but no, he'd rather not have *Das Kapital* dedicated to him. (In brief, there is such a letter, but it is to Edward Aveling; there is also a letter from C. D. to K. M., thanking him for sending a copy of *Das Kapital*; comes a busy day in 1931 when the director of the Marx-Engels Institute in Moscow is being purged and some Upwardly-Mobile Young Apparatchiks put two and two together and get eleven. . .) I have read Dr Colp with pleasure and profit: but when I found in one crucial context the date of a letter from Darwin to Marx given as October, 1971, my chief emotion was, to coin a phrase, *Freudenschade*.

It's all stuff about *toads*, anyway. The OED says *toad* comes from Anglo-Saxon *toadga* (the or take the odd extinct letter) and that has no known cognates in any other language. But the real mystery, to my mind, is what the *toads* were doing associating toads and toad stools. They associated them in stoic artefacts of toads sitting under toadstools (or according to another construe, toads with toadstools growing out of their heads) which can be found in various colours and sizes scattered all over the mao-American cultural horizon. Only three explanations come to my mind, viz: 1) The Aztecs spoke Anglo-Saxon. 2) In addition to the well-known hallucinogenic mushroom-eating cult, they had a clandestine hallucinogenic toad-eating cult; having anticipated Western pharmacology's discovery of Bufotoxin (the toadskin-factor) by several millennia. 3) Toads actually do have toadstools growing out of their heads, or did in Tewkesbury and Trochu, possibly as they plotted day by day saucers between Pyramid and Henge.

"Sir J. Paget, who necessarily has frequent opportunities for observation, has kindly attended to this point during two or three years. With English women blushing does not extend below the neck."

together; still less their followers and those who have not yet had their spontaneous feelings and reasonings completely canalized into party dogmas. Thus there is no incompatibility between Mr Steel-Maitland and Mr Foot's general attitude towards the problem. In spite of Mr Foot's Quaker leaning, towards complete pacifism. Both are clear-eyed supporters of the League principle, both are aware of the obstacles to the realization of that principle arising from the evil legacies of the War, both are the need for reduction, disarmament and control of armaments, and the consequent folly of isolationist policies. Their arguments, especially that of Mr Foot, are remarkably well-woven. The more "Young Oxford" looks at the world with these candid eyes the better for British politics.

Mr Michael Foot and Mr Keith Steel-Maitland follow in family footsteps, but plant their feet firmly for themselves. Mr Steel-Maitland's Conservatism is of the intelligent Baldwinian type, which looks at the world as it is and tries to make the best of it with the least possible disturbance to vested interests. There is practically no difference of principle between this sort of Conservatism and traditional Liberalism: the differences are partly of temperament, but mainly of emphasis and of methods and projects. On the problem of international peace there is nothing to prevent Mr Baldwin and Sir John Simon, for example, working

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COMMENTARY

A movie mausoleum

Richard Combs

Once Upon a Time in America
Various cinemas

For a film whose title takes in history, myth and fairy-tale in one breathless gulp, and whose sense of space and architecture is of like proportion, *Once Upon a Time in America* is strangely wistful, intimate and anecdotal in tone. Two anecdotes might be taken as representative. In one, a member of a gang of kids, budding hoodlums from the Jewish East Side of New York in the early 1920s, carefully selects a cake from a friend's delicatessen. He spends five cents rather than two (because that would only buy him a "hend job", and that "I can do myself"), then takes his treat to the home of the neighbourhood girl whose love of cream cakes and loose reputation make her a budding madam. Told to wait on the stairs while she is taking a bath, the boy first licks away the excess cream on his offering, then seizes its cherry, and finally scoffs the lot, just as the pleasure he has forgone emerges from her bath. A little later, while the gang is fleeing from a deadly rival, the youngest member is shot, all others into the street, and says simply, in dying disbelief, "I slipped".

The second boy dies in the arms of his confederate Noodles, who immediately avenges him by knifing his killer, then emerges from prison eight years later, grown to manhood (and now incarnated by Robert De Niro). Both stories, though, might be related to Noodles, who is so much the film's hero as its main dreamer. It begins and ends with him in a Chinese opium den, and is closest to fairy-tale

in its dream-like connections across time. As far as the film has a theme – rather than simply, and most impressively, a structure for orchestrating its sense of time – this is also Noodles's personal tragedy. The dreamer loses his life, it slips away, while he dreams it. Large blocks of time in Noodles's life do disappear: eight years in jail, thirty-five years in hiding for a betrayal which he finally learns is not what he thought it was. But more than this, there is something lost about Noodles that the film sees as an essential part of the romantic – which, although first a pimply street punk and then a gangster, is what he is: one whose image of himself doesn't "take", and whose romantic frustration twice leads him to violent rape. Like the boy on the stairs, Noodles always misses the satisfaction he thought he was after. Or, as the elusive girl of his dreams (Elizabeth McGovern) unknowingly defines his plight, tauntingly inviting him to lie there: "You can come spy on me if you like – if you have the time."

Noodles, as dreamer and spy, seems an unlikely figure to find at the centre of a gangster film; but he doesn't occupy it alone. His partner in crime, co-leader of the pack, but also Noodles's double and opposite is Max (James Woods), a more enigmatic and saturnine character, an unashamed doer of the most violent deeds (where Noodles begins to have doubts, on idealistic if not exactly moral grounds). The two first meet as teenagers – in a dispute over who has the right to relieve a drunk of his pocket watch – and thereafter Max's siren call to crime twice interrupts Noodles's quest for romantic satisfaction. Megaphonophiles and dark music, Max is more than the conventional dramatic *Doppelgänger*: he becomes the inmate, the very linchpin of the world that is

frustrating and mocking Noodles. Max's power allows him to become someone else, to change identities, and to consign Noodles to the purgatory of believing that Max has died as a result of his betrayal. It is this act of betrayal, in 1933, with which the film begins, and which it then elaborates, in leaps forward to Noodles's emergence from hiding in 1968, and back to the gang's childhood in 1922.

But the ultimate rationale for Noodles and his unconventional *modus operandi* is that *Once Upon a Time in America* is a most unlikely gangster film. Dreaming and spying are what, primarily, it is about, since the director, Sergio Leone, has constructed it as a kind of monument to cinema – or as a mausoleum, which is one of the time chambers where Noodles comes to meditate on the past. This is the sequel to Leone's *Once Upon a Time in the West* – not in the sense of a progressive historical account of America, but as a valediction to *cinemas* of America. Leone's historical recreation and evocation have a double-edged quality:

they are extraordinarily lush and sensuous, but simultaneously distanced. The emphasis on how often characters within the film are viewers of this spectacle makes the film in turn directly Leone's dream, an image of an innocent, rough-and-tumble, but cinematically governable America. The dream, of course, has its own historical ramifications, even slightly disturbing ones: *Once Upon a Time in the West* was an ode to innocence before civilization (ie, feminization), and *America* has a similar attachment to a distinctly macho prehistory. Its triumph is to have given such powerfully physical form to Jean-Luc Godard's prescription that a story should have a beginning, a middle and an end, but not necessarily in that order. Moving from period to period, from room to room, from one vast, echoing setting to another as if whole epochs were being dissolved and reassembled, *Once Upon a Time in America* is an attempt to retrieve more than Noodles's lost life. It is Europe re-imposing the dream of America.

The how, not the why

David Trotter

1984

Odeon, Haymarket

This film has many things in its favour: a "classic" text to work from, an effective last performance by Richard Burton, meticulous attention to detail, some wonderfully desolate sets and locations (all of them except the pastoral interludes drained of colour), and the best rats since Herzog's *Nosferatu*.

Maybe it has too much going for it. Like *Robinson Crusoe*, Orwell's *Nineteen Eighty-Four* seems more than a novel. Both books speak to anxieties so fundamental and so indiscriminate that we don't need to resume a particular story or a particular consciousness in order to know them again. Like *Crusoe's* fortifications, Room 101 gives us itself rather than the men and women who pass through it. Once these thoughts have been voiced they're hard to deny. The novel does not support them; they support the novel, floating it on a layer of furtive omniscience. Like Big Brother, the fable is watching you. This time, though, it does not concern beginning again so much as never ending.

The status of *Nineteen Eighty-Four* as omniscient fable seems to have been something of an affliction to the producer of the film, Simon Perry. "We were lumbered with an indescribable duty to get it right," he says, "for all time." It's not clear who did the lumbering. But lumbered they were, with deference to the original work. They have reproduced as faithfully as possible what the politics and the technology of 1948 would allow Orwell to see of 1984.

The smells of 1948, boiled cabbage and old rag masts, played their part too. *Nineteen Eighty-Four* describes the political exploitation of phobias, and it exploits phobias itself: not only the rats, but the blocked drains and unblocked

lesions. Some of these won't translate to film, of course, but Mr Parsons remains a prodigy of sweatiness; Mrs Parsons still presides over a comprehensively blocked sink. The sets and locations reveal every known variety of mould, damp, filth and decay. These buildings have collapsed for real, they're not faking it (the credits include a demolition company). The moment you see Winston Smith's first cigarette, you know it's the type that tobacco is going to fall out of, slyly.

John Hurt suffers these horrors with great conviction; it's hard to imagine anyone else playing Winston Smith, let alone playing his better. Suzanne Hamilton makes an attractive, forceful Julia. She is, however, the occasion of the film's only serious lapse. The power which Orwell attributes to pastoral sexuality – "Almost as swiftly as he had imagined it, she had torn her clothes off, and when she found them beside it was with that same magnificent gesture by which a whole civilization seemed to be annihilated" – makes a certain attention to Julia's annihilating body inevitable. But here the attention seems regulated less by any demand of the novel than by the Hollywood rule that woman can't be displayed, while men are there to enjoy the display. Statues are still commodities, in 1984.

On the whole, though, the film sticks to the details of the book. Sometimes they get in the way. Lying in bed with one's mind round Julia and the other round *The Theory and Practice of Oligarchical Collectivism*, Smith reflects that he knows the how but not the why. Unless you've read *Nineteen Eighty-Four* you won't know what he's talking about. Here as elsewhere the inclusion of a particular detail seems motivated by respect for the original work rather than by the logic of the film itself. That's the kind of film it is: honest, intelligent and evocative, but sometimes hampered by its own honesty.

AUTHOR, AUTHOR

Competition No 199
Readers are invited to identify the sources of the three quotations which follow and to send us the answers so that they reach this office not later than November 23. A prize of £20 is offered for the first correct set of answers opened on that date, or failing that the most nearly correct – in which case inspired guesswork will also be taken into consideration.

Entries, marked "Author, Author 198" on the envelope, should be addressed to the Editor, *The Times Literary Supplement*, Priority House, St John's Lane, London EC1M 4BX. The solution and results will appear on November 30.

1 By spending three-pence in a coffee-house, he might be, for some hours every day in very good company; he might dine for six-pence; breakfast on bread and milk for a penny, and do without supper on a clear shirt-day he went abroad, and paid visits.
2 "Have you got a clean shirt?" he asked Tilly. "You know you've got clean shirts," she said. "Ay, – bring me a white one."
3 In this year, one of the linen shirts he had inherited from his father, putting it before him to air at the fire.

3 "It was in this year that my uncle began to break in upon the regularity of a clean shirt" (*Tristram*).

Shandy. To-day for the first time in history I put on yesterday's shirt.

Competition No 194
This competition drew an exceptionally large and opinionated entry. The winner is J. G. Shaw.

Answers:
1: Am stillen Herd to Winterezeit, Wynn Burg und Hof mir eingeschneit. Wie elast der Lenz so lieblich lacht! Und wie er bald wohl neu erwacht Ein altes Buch, vom Ahn' vermacht Gab das mir, oft zu lesen.

Richard Wagner, *Die Meistersinger von Nürnberg*, Act 1.

2: Doch an den Fensterschelben, Wer matte die Blätter da? Ihr lacht wohl über den Träumer, Der Blumen zu Winter sah?
Wilhelm Müller, "Frühlingstraum".
Schubert: *Die Winterreise*.
3: In diesem Wetter, In diesem Braus, Nie hatt' ich geseendet die Kinder hinaus. Man hat sie getragen, getragen hinaus, Ich durfte nichts dazu sagen.
Friedrich Rückert, "Kindertotenlieder", see by Mühlstein.

Uncertain evidence

Rosemary Dinnage

Freud
BBC2

The trouble with David Suchet is that at the merest hint of a smile his eyes crinkle up into an expression of great gentleness. Where, I wondered during the first four episodes of BBC2's six-part series, was the cold Freud, the despot, the disappointed, driven mad who once opined that most people were trash? In those episodes, taking Freud up to early middle age, what we see is an impulsive, ingenious, open-hearted fellow. Not until the fifth episode, along with the powder streaked into the beard, is some slight ferocity added to the character.

This discrepancy apart, Suchet's performance is a wonder; visually he is authentic too, spare from a little extra weight – those chubby paws continually lighting up cigars are not quite right. Other characters are equally carefully matched up to photographs – except, of course, for the women. Traditions decreed that the plain and plump Bernays sisters (wife and sister-in-law to Freud) should be played by two ravishing young actresses. This is a convention straight from Hollywood, pleasant for the viewer but still a hindrance to suspension of disbelief.

Backgrounds, costumes, casting are all immaculate. The photography of *fin-de-siècle* Austria provides a fine foil, sometimes pale and pretty, sometimes glowing, for Freud's stark black-and-white in the foreground. Perhaps there are rather too many shots of small Alpine vistas; but these do, after all, exist in plenty outside colour supplement advertisements and this was where the middle-European bourgeois spent his holiday.

Writing in its region

Peter Kemp

Poets and People
Channel 4

As its format emphasizes, Channel 4's *Poets and People* actually pays most attention to poets and places. Each programme opens with John McGrath – the producer and presenter – putting a poet in some local context from Leeds to Lochmav. Film and photographs reconstruct the regional matrix that helped shape a body of work: the northern industrial background of Tony Harrison; the stark Scottish countryside and Edinburgh urbanity between which Norman MacCaig divides his time; Douglas Dunn's Redferrishire. Then, to an audience drawn from the district much of his writing is rooted in, each poet reads a selection of his work. To complete the putting-in-perspective, he intersperses it with handy bits of personal elucidation.

Easily the most riveting programme is that with Tony Harrison, whose poetry has been a ideal platform. Perhaps because so much of his work as a translator – of plays and libretti – is designed for oral delivery, his poetry finds it hard to stop talking about speech or the impingement of it. Arranged in a telling sequence, the selection he reads conveys this eloquently. "Heredit", the opening item, voices – only half-ironically – the notion that Harrison was impelled towards his verbal vocation by his background of inarticulacy: "I had two uncles, Joe and Harry – one was a stammerer, the other dumb". Tongues, subsequent poems show, always catch his attention: living and dead languages, regional and social dialects are constantly turned to as subject-matter. Actually aware of both class and the classics, Harrison throws these together to strike sparks in a number of fiery poems: "Classics Society", very sardonically spoken here, is a neatly chosen example of this. In a similar vein, "Them and I" verbally re-enacts Harrison's chagrin as a pupil at Leeds Grammar School: "I doffed my flat cap (as in 'flat cap') – when a master who was a martinet for received pronunciation jeered at his boyhood dialect (in which 'doffed' glided like poured pop)" as another poem has it.

Later works in Harrison's programme speak of the silences that started to gape – as education closed round him – between him and his working-class father and mother. Despite this, it seems, deeper attachments held – tensely felt even after his parents' death. A poem like "Continuous" – given a poignant, powerful rendering by Harrison – unpicks the way near-random strands of recollection plait into an unmissable link with childhood and family past. Unmistakably emotional, this piece strikes a note sustained in his final choice, "A Kumquat for John Keats". Here, oral responsiveness of another sort is to the fore. The poem – partly inspired, Harrison explains, by Keats's taste for mouthful delicacies – imaginatively savours all aspects of the fruit it picks as a metaphor for the bitter-sweet zest of life in middle age. Mentally making the kumquat's "perishable relish prick the tongue", Harrison catches – in couplets that are both robust and sensitive – the differing pungencies and scintillating ripeness can offer.

His rendering of the poem is the high-spot not only of that programme but of the series, since neither of his successors manages to attain a matching intensity. Norman MacCaig sometimes drops to the merely whimsical – as in a piece about a girl waking from a nightmare to find herself paved by King Kong. His linking commentary can be arch ("Wasn't I lucky that fitted the metre?") or twinklingly mock-pedantic ("Mr John Milton, the great poet"). Closeness keeps smothering flair – though his sharp eye for natural detail ensures that imagination-catching fauna periodically come into view: a toad "crawling like a Japanese wrestler" that "Hooverer of the sea's bed" a crayfish.

Douglas Dunn's selection starts with an emphasis on transport – a poem about Glasgow's buses, another about a girl ridden by her witch-mother. Despite this, the pervading tone remains pedestrian. Driving force seems absent from the verse. Even Dunn's political pieces, fuelled with indignation, spatter rather than roar. Flatness means things never get moving as vigorously as they do in the earlier programmes. None the less, *Poets and People* is an admirable venture, one more innovative example of Channel 4's praiseworthy willingness to tackle the problems of transmitting poetry on television.

COMMENTARY



A plate from W. Eugene Smith's *Pittsburgh series*, 1955-6, reproduced in *The Archive* for July 1984; subscriptions, of \$35 for four issues, should be sent to the Center for Creative Photography, University of Arizona, 843 E University Blvd, Tucson, AZ 85719.

on only two things: hints to interviewers from Jung late in life, and a case built up by the researcher Peter Swales, who acted as one of the advisers to the series.

One-time assistant to the Rolling Stones, interested (he declares) in "drugs, sex, rock and roll, Jews, psychopathology, the history of religions", Swales has been called every kind of name from the "punk historian of psychoanalysis" to Freud's character assassin. He is neither analyst nor academic, but nevertheless an ingenious and obsessive literary detective who makes journeys across Europe to check a nineteenth-century train timetable or hotel register. He is quoted by Janet Malcolm in her recent *In the Freud Archives* as saying that Freud was a sinister man and that what he (Swales) is doing is "declaring war on a whole profession – that of psychoanalysis". He is also at war with the other Freud iconoclast, Jeffrey Masson.

Episode 4 of *Freud*, where the themes of Miens, Rome, a professorship, and the Oedipal tie are mixed together in a dreamlike sequence, is easier to understand in the light of Swales's paper "Freud, Minna Bernays, and

the Conquest of Rome". Swales's argument is immensely detailed and based upon a re-analysis of episodes from *The Psychopathology of Everyday Life* and elsewhere. Briefly, he argues that Freud equated his private taboo against visiting Rome with the taboo against maternal incest; that the year before "conquering" Rome he broke the latter taboo by making love to his sister-in-law, which was both literally incest and also so in a childhood sense – Minna being one of his children's two "mothers", as his Catholic nursemaid was one of his own two. Using several other sources he further argues that Minna, when she stayed away from the family for several months in 1900, was having an abortion. The article is very persuasive, but not conclusive; Freud certainly did travel with his sister-in-law, but the fact that it was so openly done might argue for its innocence.

Freud was no plaster saint, and the time for psychoanalytical hagiography should be over; he was perhaps not even a very nice man. But the Minna episode remains conjecture, and we may doubt whether it was fair to make it so pivotal.

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Making a meal of it

Peter Hebblethwaite

GORDON THOMAS and MAX MORGAN-WITTS
The Year of Armageddon: The Pope and the bomb
426pp. Granada. £10.95.
0246 122455

There can be no doubt that Gordon Thomas and Max Morgan-Witts, from their haven in the depths of Ireland, can stitch together a rattling good yarn. Last year *Pontiff* made a few headlines – mostly about how Cardinals Hume and König denied having given the interviews attributed to them. Capitalizing on their notoriety, and claiming unconvincingly that *Pontiff* "drew comforting critical acclaim from important Roman Catholic and secular commentators", they have now dared to write *The Year of Armageddon*. It is cast in the form of a Roman diary for the year 1983. Since we survived 1983 without a nuclear weapon being fired in anger, the title is a melodramatic misnomer. Armageddon was postponed.

But our authors are not content to be story-tellers. They introduce themselves as "social historians" toiling away at the coal-face of "the human sciences". To further their research, they "set up a network of secure restaurants in Rome". So on one level the book may be read as a guide to gastronomic Rome. As such, it is unreliable: the baby lamb and tiny Roman artichokes they enjoy cannot have been washed down with Capri Chianti since no such wine exists (it's like talking about Parisian Burgundy or Lancashire Cheddar).

Despite such lapses, Thomas and Morgan-Witts claim to apply the most rigorous standards of fact-checking as per *Reader's Digest*. They high-mindedly reject the use of bribes to elicit information (sixty dollars is the going Vatican rate, they say). They generously offer to provide free information to the Vatican – and are surprised when they are rebuffed. Moreover, they get caught up in the story they tell. They introduce a major motorway in Ireland to some hostile intelligence agency. Clearly the life of a Vaticanologist (such as they claim to be) is never dull: it's all meals and thrills.

The authors have, as usual, a "sensational revelation" to produce from somewhere up their sleeve. It is that from November 1978, shortly after the election of Pope John Paul II, the Vatican began to receive regular weekly briefings from the CIA. The assistant press officer at the Vatican, Doni Pierfrancesco Pastore, has categorically denied this. But his *démarche* do not carry great weight, and are usually regarded as a confirmation: he wouldn't know, anyway.

I think we are meant to find it shocking and scandalous that the Vatican should be receiving CIA reports. Yet it seems fairly obvious that friendly states will exchange intelligence information where they have overlapping interests. It follows from the existence of the Holy See as a mini-state with an international diplomatic service. The "revelation" only becomes alarming if it can be shown that the CIA information has determined Vatican policies. This is the principal thesis of our authors: "Increasingly his [the Pope's] decisions, his policies, his speeches and pronouncements take into account the CIA briefings he has received." They allege, in other words, that Pope John Paul has abandoned the traditional Vatican neutrality and even-handedness, and allowed himself to be dominated by his anti-Soviet and anti-Russian feelings.

This is a question worth discussing. But no appeal to arcane or privileged "intelligence sources" is required. American policies throughout 1983 were clear enough, and the Vatican's policies can be studied in the Pope's words and actions. The allegation that Vatican policies were shaped by US intelligence can be tested by examining three examples discussed by Thomas and Morgan-Witts: the papal speech to the diplomatic corps in January 1983; the special Rome meeting on the US Bishops' pastoral letter on nuclear weapons; and the Central American visit in March.

Characteristically, instead of giving us the text of the Pope's speech to the diplomats, the authors picture him the night before, carefully putting the finishing touches to his address, in the light of the latest CIA reports. "The Pope is

going to reserve his sharpest criticisms for what is happening in Afghanistan, Iran and Iraq, all areas of current Soviet influence." This is a puzzling judgment: Iran and Iraq were at war. And one can't help feeling that if that's the worst the Pope could find to say about the Soviet Union, then it got off rather lightly.

In any case, in this same speech (as the authors admit in a footnote), Pope John Paul also denounced those governments "who make a certain number of people disappear without trial, leaving their families in a state of cruel uncertainty" (Vaticanese for Argentina and Chile). An even greater departure from US policies came when the Pope deplored "outside interference" in Central America. If that excluded Cuba and the Soviet Union, it also excluded the United States. So on this point the Pope was closer to the Contadora group than to President Reagan. No spies are needed to reach this conclusion: one simply reads the Pope's speech in *L'Osservatore Romano*.

Their account of the January 18-19, 1983, Roman consultation on the American Bishops' pastoral is equally unreliable, and for the same reason: they always prefer what some monsignor said (ie, gossip) to the plain and published record (*Origins*, April 7, 1983). The American Bishops were not "on trial" at this meeting. The draft of their pastoral letter was not emasculated. The discussion did not depend on strategic or intelligence considerations but on theological ones. The American Bishops were reminded that there was more mileage in the traditional "just war" theory than they supposed, and that the mainstream Christian tradition was not "pacifist". But they could take these points aboard without too much difficulty, and the final version of their pastoral letter deeply upset the Reagan administration. The whole episode therefore shows the incapacity of the State Department and the CIA to influence the Vatican.

The visit to Central America in March 1983 seems at first sight to confirm the authors' thesis of collusion. Pope John Paul roundly denounced the Sandinistas on their home ground in Managua, and was heckled. But they ignore completely the fact that the "briefing" that influenced the Pope came from a report prepared for CELAM, the Latin American Bishops' Conference, then headed by Archbishop (now Cardinal) Alfonso López Trujillo. That it overlapped with some American positions is undeniable; both share an implacable hostility towards "liberation theology" (having first badly misunderstood it).

But the Pope's support for American policies was far from across the board. In El Salvador he prayed at the tomb of the martyred Archbishop Oscar Romero, while neither the government nor the State Department wanted. And he pleaded for a "dialogue" with the guerrillas, contrary to US policy which sought their defeat. So it is false to say that throughout 1983 Vatican policies were aligned on those of the United States. Neither the CIA nor the State Department had the influence attributed to them.

All this is a matter of public record. Thomas and Morgan-Witts spurn anything that is public knowledge and prefer what they are told by chaps over lunch. Thus they give a list of papal audiences for a particular day and footnote it: "This schedule of papal appointments was provided by [Fr Lambert] Greenan." A staggering revelation: they could have read it in *L'Osservatore Romano*, which as professional Vaticanologists they have a duty to read. But Greenan, an Ulsterman not greatly esteemed by his Dominican brethren, is one of their favourite lunch partners. He appears as "the waggish, waspish, hard-headed and straight-talking editor of the English-language edition of *L'Osservatore Romano*". After one particularly bibulous lunch at Rascals's (the one where they drank Capri Chianti), the good father staggers off "to say an early evening Mass" with the penetrating remark: "Good luck, lads." It had been a useful lunch; they remark. Are they trying to get Fr Greenan sacked?

But the most memorable meal is undoubtedly the dinner with Dr Rudi of the German Intelligence Service. Over melon and caviar washed down with ice-cold vodka, he "reveals" what the Pope said to a Bulgarian delegation. He says some things that other sources said, but no matter. They are afraid

beef, rare, garnished with sliced truffles, button onions and potato puffs dipped in mustard roux and deep-fried. By the time they reach the *spumante* and crêpes, Dr Rudi has got round to suggesting that the CIA has a blackmail hold on the Vatican. He tells them: "It must have occurred to you that the last thing the Pope wants is to have the good old Com-pany [ie, the CIA] spreading stories about his Vatican Bank. It's one thing to have the Italians snapping at his heels. It would be another if the CIA got into the business of spreading poison about the bank."

Now that is an interesting after-dinner story. Unfortunately they do not pursue it because they have decided in advance to "exclude the burgeoning scandal surrounding the so-called 'P-2 Masonic Lodge' of Arezzo, near Florence". This self-denying ordinance prevents them from seeing the significance – even though it supports their main thesis – of the way Archbishop Paul Marcinkus has been protected both by the Vatican and the CIA. Nor do they ask whether there are links between Marcinkus and William Wilson, popularly known as "Mr Gaffe", the sun-tanned Knight of Malta who is now the US Ambassador to the Holy See. It may simply be that they were in a hurry. On the way to the bank.

Credit where credit is due, they have one scoop: a series of interviews with Mgr Emery Kabongo, the Pope's Zairean personal secretary.

Amateurs in Albania

C. M. Woodhouse

NICHOLAS BETHELL
The Great Betrayal: The untold story of Kim Philby's biggest coup
214pp. Hodder and Stoughton. £9.95.
0340 357010

It is easier, unfortunately, to coerce one's friends than one's enemies; and that is what the Western allies did to most of the anti-Communist leaders in Eastern Europe after the Second World War. Those who could not be coerced into accepting Stalinism were abandoned. Amazingly, some of them survived and escaped abroad, and were even ready to trust their Western allies again. In the case of the Albanians, they were then further betrayed. This time, betrayal was more than a metaphor, for it was organized by a professional traitor called Philby. Nicholas Bethell in *The Great Betrayal* tells the story with a cool objectivity which does not minimize its bitterness.

Albania seems to have been doomed to be the victim of foreign predators throughout its history. Populated by rival tribes, speaking different languages and following different religions and ideologies, the country had little chance of becoming a nation. The Italians, Greeks and Yugoslavs all had territorial ambitions in the country long before it became a target of the Russians, the British, or the Americans. Stalin once urged Tito to "swallow" Albania. But if Tito had invaded Albania from the north-east, where he had a considerable Albanian minority of his own, the Greeks would have been tempted to do the same from the south. So Enver Hoxha's Albania has survived.

Lord Bethell describes the historical background with his customary lucidity. He rightly sets the decision of first the British and then the Americans to intervene in Albania in the broad context of the Cold War. The Bolshevikization of Eastern Europe reached its climax in 1948-49, but there were already indications that the Soviet bloc was vulnerable, especially after the defection of Tito and the Greek government's victory over Communist rebels. Albania was being developed as Stalin's base in the Mediterranean, but its primitive economy and its isolation from the rest of the Soviet bloc suggested that it was the natural point at which to start trying to roll back the Iron Curtain.

Why did the attempt to do so fail? The treachery of Philby, who was then a senior officer in the Secret Intelligence Service, is not the whole explanation. The operation mounted in Albania pitted a group of well-meaning amateurs against a vicious police state; and the latter was almost certain to win, even without Philby's betrayal of the plans to the Soviet security service.

He provided their title: "The Pope's War: spiritual Hercules trying to keep the superpowers apart, trying to avert Armageddon. Understanding that it is crucial to grasping all else that is happening in the pontificate." It remains a puzzling remark. The way to avert Armageddon is to bring the superpowers together, not to keep them apart; and the process is not helped by antagonizing one of them and making use, however indirectly, of the intelligence service of the other. It should be said, however, that despite their many lunches and dinners, the authors are unable to quote a single CIA report to the Vatican in this pontificate. The truth is that they are on the outside peering in. The only CIA report they quote dates from 1963 and they get it wrong. James W. Spain's May 13 report (declassified on March 9, 1978) is said to have "castigated Pope John's burgeoning Ostpolitik". They can't have read it, for on the contrary it explained the reasons for Pope John's Ostpolitik, and led to a message from President Kennedy saying that his administration "deplores and regards as unfounded the insinuations made in the press and in certain political circles". This could have been checked in *Reader's Digest* style by calling James W. Spain, who is alive and well and living in Washington.

In short this is the sort of book that gives Vaticanology a bad name. It makes a considerable contribution to error, and none to truth.

George Szamuely

CHRISTER JÖNSSON
Superpower: Comparing American and Soviet foreign policy
248pp. Frances Pinter. £18.50.
0861873777

Svetlana Alliluyeva, Stalin's daughter, declared recently that she feels the day is coming when the United States and the Soviet Union will realize that far more unites than divides them. They will use this opportunity to, as it were, "fall into one another's arms". She was not voicing an original thought. The widespread suspicion that behind the belligerent rhetoric of Moscow and Washington there exists a tacit understanding between the two states (a "superpower condominium", as the jargon has it) is the subject of Christer Jönsson's book.

Promising to be a comparison of Soviet and American foreign policy, his work is in fact only a survey of writing which already assumes either considerable similarity or the existence of an undeclared partnership (the two are not synonymous though they are often taken as such). From his sources Jönsson extracts the notion – by now quite widely held yet still rather strange – of a "superpower" without any

The miseries of the liberated

R.B.Smith

NGUYEN VAN CANH with EARLE COOPER
Vietnam under Communism, 1975-1982
312pp. Stanford: Hoover Institution Press.
0317978518

To quote the dust-jacket, this book is "out of the work of a disengaged foreign observer". It is, indeed, an account of developments in Vietnam since reunification by a Vietnamese who, before 1975, was committed to the cause of an independent Saigon régime and who now lives in the United States. That need not mean, however, that it is factually unsound; nor that the interpretation it offers – although marred in places by too much emotio – has no relevance to current realities in the Socialist Republic of Vietnam. Certainly it provides a corrective to the opinion of anyone who still believes the claims made by the National Liberation Front, while war was still in progress, that once the Americans had been driven out South Vietnam would be taken over by genuine patriots who would remain independent of "international Communism". Nguyen Van Canh demonstrates at the outset that the "Provisional Revolutionary Government of South Vietnam" created in 1969 was little more than window-dressing; and that what actually happened in May 1975 was that all significant positions of authority south of the 17th parallel were immediately taken over by cadres from Hanoi. He goes on to offer detailed evidence for his contention that the assimilation of the South into a unified Communist Vietnam has brought suffering rather than "liberation" to the majority of its people; and that life under the new régime is on the whole worse, both culturally and materially, than it was under the "dictatorships" of Ngo Dinh Diem and Nguyen Van Thieu.

Not all of the book is polemical, however. It provides a useful compendium of factual information about the institutions, policies and economy of contemporary Vietnam – including an analysis of the state Constitution of 1980 and of the way the Vietnamese Communist Party is organized. There is also a good deal of hard fact on measures directed towards religious groups and potential dissidents; an account of the "bamboo gulag" of re-education centres; and some statistics on the exodus of the "boat people" since 1978. The picture obviously differs in emphasis from what one might find in an official Communist description of the country; but apart from occasional errors of detail, this factual survey does not appear to be radically unsound. The harsh social discipline and material poverty of the country can hardly be disputed, and the book will make salutary reading for anyone who imagines that since 1975 the Socialist Republic of Vietnam has been a land of peace and prosperity.

national interests of its own to pursue, only a "role" to play out on the world stage. Nothing more serious is ever at stake for a superpower than the loss of an opportunity to act so as to live up to its image of itself. Moreover, as Jönsson puts it, "rivalry with the other superpower looms large in the role conception of either giant. Each uses this rivalry to define its own identity and purpose." American and Soviet conduct strikes us as so similar because each has an identical conception of the "role" a superpower must play. Their foreign policy should be understood as signals directed at one another's capitals, as an elaborate ritual played out between two protagonists, each of whom is ready to leave the other enough of the stage to enact a role fit for a state with superpower status.

Who has the best lines? Unquestionably, Jönsson says, the United States: for it alone has the capacity to exert pressure of varying degrees of subtlety on other nations by means of its manifold economic influence. The Russians on the other hand, can only threaten other states with their military might. Anxious to acquire the rank of a "superpower", the Soviet Union has sought to emulate the United States, faithfully reproducing its actions and even its rhetoric. Jönsson writes that "imperialism" came to play a role in Soviet ideology similar to that of "totalitarianism" in American ideology.

of Vietnam has succeeded in fulfilling Ho Chi Minh's injunction to rebuild the country "ten times more beautiful".

The specialist reader, on the other hand, might have hoped for a more penetrating analysis of the available source material. Professor Canh offers some essential statistics – and also pays close attention to the "black" economy without which he believes the system as a whole could not survive. But he does not go into the major economic debates which are known to have preceded review of the second five-year plan in 1976; nor into the precise consequences of Vietnamese entry into the COMECON grouping two years later. In analysing Party policies he has a good deal to say about "factionalism", but he demonstrates little knowledge of the early history of the Party; and much of what he does say on that subject is not attributed to precise sources but is hedged about with such phrases as "presumably protégé of..." or "according to some analysts...". He makes little attempt to analyse in depth known writings of Le Duan, Truong Chinh and other senior figures, which might have provided clearer insight into genuine differences of opinion that have arisen within the top leadership over the years.

Towards the end, two chapters deal with "foreign policy" including useful summaries of Hanoi's exchanges with the United States and with the Association of South-East Asian Nations since 1975; as well as some account of relations with China and the Soviet Union. In relegating the latter topic to such a late stage of the book, however, and by separating it from his analysis of "internal" policies, the author fails to recognize the all-pervading consequences of international Communist relations for Vietnam. Throughout these years, relations with China and the Soviet Union – and the pursuit of domination over Kampuchea – were related aspects of a continuing debate at the highest level in Hanoi. Decisions in that sphere cannot be divorced from such important "internal" policies as the rapid assimilation of the South announced in November 1975 while Le Duan himself was visiting Moscow. That notion that Hanoi "chose Moscow" only in 1978; and that it did so merely because of the "victory of a 'pro-Soviet' over a 'pro-Chinese' faction in Hanoi itself; may have the advantage of simplicity. The international realities of the "world socialist system" are far more complex, and Nguyen Van Canh does not do justice to them.

In *Peacekeeping in Vietnam: Canada, Poland, and the International Commission* (375pp. The University of Alberta Press. £19.088864 037 4) Ramnath Thakur examines the three delegations to the Commission and discusses the role of international politics in peacekeeping operations. It is a book that will be of interest to those who are concerned with the role of international politics in peacekeeping operations.

ican ideology". Following the Truman Doctrine's demarcation of the "free world" from the "communist world", Zhdanov immediately put forward the notion of international politics as a struggle between the "socialist" and the "imperialist" camps. The concepts used by the Johnson Administration to justify its intervention in the Dominican Republic in 1965 turned up three years later in the Brezhnev Doctrine promulgated after the Czechoslovakia crisis. (The author even speculates about the existence of a post-Afghanistan war-weariness among policy-makers in the Soviet Union similar to the traumas suffered by their American counterparts in the early 1970s.)

The book concentrates on three areas where the pattern of superpower rivalry may be discerned with the greatest clarity: aid to the Third World, the crises in the Middle East, and the issues surrounding nuclear non-proliferation. Events take an almost identical course in each case, which can roughly be described as follows: after the triumphant victory of 1945 the pace is set by an enthusiastic United States offering economic, military and sometimes even nuclear assistance to almost anyone; when, within about ten years, the Russians enter the field, the result is that states other than the immediate military allies of the superpowers are able to play Moscow and Washington off against each other. Consequently disillusionment sets in: little has been achieved and substantial liabilities have been incurred because of the rapaciousness of client states. Nevertheless, despite the fact that through their rivalry they have frittered away opportunities to influence events, the superpowers appear to be in no hurry to pursue agreed policy towards third states.

The reader will, no doubt, wonder why the motives of American and Soviet foreign policy makers should be so similar given how dissimilar, even by Jönsson's account, is the historical experience of the two states, their economic capabilities, and their institutionalized methods of allocating power. The assumption

that seems to underlie this book is that what the Russian and the American people have in common is their sense of having been chosen to fulfil a mission. The conduct of the two states betrays a contradiction (probably more apparent than real) present in both national characters. Each possesses a tendency towards self-glorification which, on the one hand, urges it to transform the world in the image of itself and eradicate the vice of which one's adversary is the symbol, and at the same time compels it to flee the world and strive merely to perfect itself in solitude. This trait is reflected in foreign policy. Jönsson writes: "Just as debates over... American foreign policy have... been conducted in terms of isolation versus globalism/interventionism, so Soviet foreign policy has generally been discussed in terms of... national protection versus world communism."

Such an account is unsatisfactory. No doubt the concept of "roles" enacted by superpowers without any regard to their real national interests can serve a useful polemical function in demonstrating how little either the United States or the Soviet Union has succeeded, since the last war, in enhancing its power and authority. A policy that concerns itself solely with compelling others to acknowledge one's superpower status will inevitably lead to wasted resources, squandered prestige and numerous liabilities. But an account of foreign policy ought to be more than this: it needs to identify the evolving circumstances that cause a superpower, like any other power, to change its understanding of its national interest, and to undertake actions that are only sometimes consistent with the general trend of policy. A starting point for a comparison might then be the question as to why changes in American foreign policy are almost always intelligible solely in terms of domestic political considerations, whereas with the Soviet Union they are usually responses to new external circumstances. What is needed is a picture of change, not of stasis.

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SCIENCE, TECHNOLOGY & SOCIETY IN THE TIME OF ALFRED NOBEL

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determined. The stories of the culture, or "the-mata", as Gerald Holton calls them, go largely undescribed: symmetry, simplicity, development, hierarchy, chance, provide models, ideals and implied narratives in science as much as literature. From time to time, such sequestered stories move out from beneath description into debate, as has recently been the case with hierarchy in work such as that of Allen and Starr, *Hierarchy: Perspectives for ecological complexity* (1982).

The apparent neutrality of description is the source of much of its authority; it is openly informative, but it is also more covertly predictive. Description stands in place of assertion and prediction. Even more importantly, it works at an agreed upper level of specification, and ignores (and is often ignorant of) shared and unmarked assumptions. When we describe the taken-for-granted we change its status; "an old yellow car on wheels": the last phrase is either redundant or crucial. This observation does not, of course, apply only to scientific discourse; it is powerful throughout literary language. Beckett gains many of his most disturbing effects by detailed recounting of reflex actions of the body usually left undescribed.

Empson's "Doctrinal Point" observes precisely the false triumph of teleology in description. By using metaphors from natural growth and development, the project of both scientist and poet becomes self-fulfilling. How can we distinguish design from description? How prevent "the Assumption of the description" since description creates its own transcendental level? Through the multiplying senses of *assumption* he shows this transformation at work.

The god approached dissolves into the air.

Magnoliss, for instance, when in bud,
Are right in doing anything they can think of,
Free by predestination in the blood,
Saved by their own sap, shed for themselves,
Their texture can impose their architecture;
Their sapient matter is always already informed.
Whether they burgeon, massed wax flames, or
flame
Plump, spaced-out, saints, in their gross prime, at
prayer.

Or leave the sooted branches bare
To sag at tip from a sole blossom there
They know no act that will not make them fair.

Professor Eddington with the same insolence
Called all physics one tautology;
If you describe things with the right tensors
All law becomes the fact that they can be described with them;
This is the Assumption of the description.
The duality of choice becomes the singularity of existence;
The effort of virtue the unconsciousness of foreknowledge.

"The Assumption" of the description raises into essence what began as account – and it presumes, or "assumes", uses its own "assumptions" as a means to authority without bringing them into question: so Empson suggests in the caustic second verse of a poem which opens in sumptuous enjoyment of the aptness of the mogolla to its own performance, the perfect accord of possibility and purpose, form and information, sap and sapience:

In *The Nature of the Physical World* (1928), Eddington commented on the tendency of the mind to recover its own anticipated patterns from the universe, what Empson calls "tautology": "the mind has by its selective power filled the processes of Nature into a frame of law of a pattern largely of its own choosing; and in the discovery of this system of law the mind may be regarded as regaining from Nature that which the mind has put into nature".

Darwin's sturdy sense of a thronging physical world only partly within the domain of human reason is tempered further in Einstein's essay on Clerk Maxwell in the collection perhaps riddlingly entitled *The World As I See It*: "The belief in an external world independent of the perceiving subject is the basis of natural science. Since, however, sense perception only gives information of this external world or of physical reality indirectly, we can only grasp the latter by speculative means. It follows from this that our notions of physical reality can never be final."

Umberto Eco, among others, has entered an important caveat on the question of "ingenious transposition" from one field to another.

Epistemological thinkers connected with quantum methodology have rightly warned against an ingenious transposition of physical categories into the fields of ethics and psychology (for example, the identification of indeterminacy with moral freedom). Hence it would not be justified to understand his formulation as analogy between the structure of the work of art and the supposed structure of the world. Indeterminacy, complementarity, non-causality are not modes of being in the physical world, but systems for describing it in a convenient way. (*The Role of the Reader*, 1979).

Scientists seek to de-limit the application of their terms and respect the exigencies of their topic. But at the same time it is essential to recognize that any such containment of meaning will be local, and temporary. It may allow a satisfactory completion of a phase of discussion and demonstration, but it cannot be held enclosed once it is read by other readers or in a different context of discussion. And this is not a matter of careless or ignorant reading by those outside the technical argument (though it may sometimes also be that); it is that the insurgency of signification, the perception of fresh relations, is inherent to language – and particularly to that intensified form of discourse which we call "literary language".

Literary language moves with great flexibility from level to level, achieving much of its intensity by means of allusion and connotation across levels. Such language opens out connections which technical discourses exclude from notice and, Rose suggests, at their most honest must abjure considering. Yet, for any appraisal of complexity many kinds of description are needed. An example of such unfolding, re-connecting, and enwebbing, is to be found in the opening of Adrienne Rich's poem "Waking in the Dark":

The thing that arrests me is
how we are composed of molecules
(he showed me the figure in the paving
stones)
arranged without our knowledge and consent
like the wirephoto composed
of millions of dots
in which the man from Bangladesh
walks starving
on the front page
knowing nothing about it
which is his presence for the world.

The human body as "molecules", and the "millions of dots" which compose the newspaper photograph of the starving man, are both seen as part of an order which dangles "our knowledge and consent". The shift from molecules to information suggests a congruity between them which does not need to be voiced. What is voiced is the sense of exposure and helplessness that the poet feels both in her arranged body and in her unwilling not of voyeurism, looking at the man starving "on the front page, knowing nothing about it".

The human body is exposed, not only to a watchtower out there, but in its predetermined composition irrelevant to will or individuality. She is "arrested" – imprisoned as well as startled. In the poem there lurks a further recognition, that the starving man knows nothing either of the poem or its language, that print, as much as those other "millions of dots" of the wirephoto, cannot connect with the man's starvation. Knowledge is not solution; the power to perceive connections may itself be a trap which has no issue.

The enterprises of scientist and writer act out the paradox that narrative implies teleology even when its argument denies it: The sense of the forlornness in the imprinting of writing, the process of discovery which has become disclosure, the fact that the book ends (even when the argument of the ending is peremptory and unresolved): all this makes for an organization in which the future is already disposed, and is thus apparently under the control at least of the writer's description, if not of his free choosing. Narrative implies successful prediction. The attempt to break out of a prediction-dominated narrative was one of the most important features of the French New Novel – Ponge's *Poésies*, for example – and the attempt was strongly connected to a distrust of the anthropomorphism of language, particularly in Robbe-Grillet's work.

In Thomas Pynchon's *The Crying of Lot 49*

the problems of the observer, within the system or outside it, and of the self-referential nature of any cyclic system are examined in another work which allures the reader with a promise of system, enigmatically disavowed. The heroine here is named deconstructively. She is Oedipa Maas (Maas), the stand of the traditional male scientific exploring a female "Nature", we are shown a woman exploring an information system dominated by minute scientists, psychoanalysts, playwrights and writers. The "maas" she enters turns out to be a closed system in which not only the topic but the materials of the writing are part of a sinister chain, economic, political, scientific, literary. Cigarette filters, and the ink with which the writer writes, the printer prints, are products of the bones of drowned and murdered man. Here, information theory, religious language, and entropy are overtly linked. Coincidence proves – or seems – to be coded warning: "What, tonight, was chance?" First invention, it appears, is no longer possible for scientist or writer:

how can you blame them for being maybe a little bitter? Look what's happening to them. In school they got brainwashed, like all of us, into believing the myth of the American Inventor – Morse and his telegraph, Bell and his telephone, Edison and his light bulb, Tom Swift and his this or that. Only one man per invention. Then when they grew up they found they had to sign all their rights to a monster like Yoyodyne; got stuck on some "project" or "task force" or "team" and started being ground into anonymity. Nobody wanted them to invent – only perform their little role in a design ritual, already set down for them in some procedures handbook.

And yet at the book's conclusion there remains just the possibility of what Eddington calls "anti-chance", the cheater or demon in the system.

Scientific ideas and writing are often of most value within literature precisely where the risks of translation are great. We should not look for stable one-to-one correspondences between scientific exposition and literary creative. Works of art press on the uncontrolled implications of scientific theory while new scientific ideas, theories and products not only create knowledge but make it possible to articulate what has earlier been taken for granted and is was not available to be recounted, embedded as it was in assumptions beneath the level of description.

Fresh scientific and technical knowledge allows the poet to contemplate with intensity intransectal questions which grip language in all generations. For example, the intervention of a new scientific meaning for a word (a meaning which we must now retrieve) poignantly marks the shifting of levels in Donne's poem "A Nocturnal upon S. Lucies Day, Being the Shortest Day". The poem is an act of mourning. The "Nocturnal" was, when Donne wrote, a very recently invented astronomical instrument for telling the time without the sun, at night by the stars.

The poem opens:

Tis the year's midnight, and 'tis the day's,
Lucies, who scarce seven hours herself unmasks
"The Sunna is spent": the woman whom the poem mourns is dead. The poem itself becomes the poet's "nocturnal", an instrument for telling the time, keeping his bearings as he moves through the darkness of grief.

I am re-begot
Of essence, darkness, death; things which are not.
He is, yet, "Of the first nothing, the Eternity grown".

All, all some properties lavest;
If I an ordinary nothing were,
As shadow, a light, and body must be here.
Shadow implies light, but he is beyond all such renewal. Donne intensifies the expectation of the return of light and the coming of dawn by combining in his night-piece the new literature, the "nocturnal", and an allusion back to the old monastic form of service, matins, which took place at three a.m., long before dawn and consisted of three "nocturns", each of which brought the hour nearer to the light. But within this poem day never returns, "nor will my Sunne renew". It ends:

Since she enjoys her long nights festivity,
Let me prepare towards her, and let me go
This hour her Vigil, and her Eve, since she
Both the years, and the dayes deep midnight is.
"The nocturnal" becomes the poem's only measure.

Science fiction and the art of conjecture

Umberto Eco

We are often tempted to lump different kinds of books together as Science Fiction, provided they deal with futuristic worlds: in short, with some Outer Space. In this sense SF is nothing but a modern version of the Romance or even the chivalresque novel, with space-ships and alien monsters replacing enchanted castles and dragons. But can we stretch our definition of SF that far without talking – in over-general terms – of the essence of epic, myths and the picaresque?

It is a fact that, from the earliest times, and in contrast to so-called realistic narratives, there have been narratives also which build structurally possible worlds. I say "structurally possible worlds" because of course any work of narrative, even the most realistic, depicts a possible world inasmuch as it presents a population of individuals and a succession of states of the world that do not correspond to those of our everyday experience. Let us henceforth call this the "real" or "normal", the world to which we live, or presume to live, as defined by common sense or by the cultural encyclopedia of the day – even though it does not follow (as Berkeley taught) that it is real and it may not answer to any norm.

A realistic narrative is, however, always constructed out of a series of "counterfactual conditionals". What would have happened had an individual of such and such a kind named Rastignac existed in the real world of nineteenth-century France? Or if a possible individual called the Count of Monte Cristo had effectively altered prices on the Paris stock exchange by manipulating the report transmitted by the optical telegraph? Events which are narrated "realistically" are also counterfactual relative to the events of the real world, but realistic narrative exploits counterfactuals of the type: "What would happen if, in a world biologically, cosmologically and socially similar to the normal one, there occurred events which did not occur in fact but which nevertheless are not inconsistent with its logic?" Realistic narrative operates as we ourselves operate, with the counterfactuals off which we feed in everyday life: "What would happen to me at this moment if I stopped drafting this essay and smashed my word processor?"

What distinguishes the fantastic narrative from the realistic, on the other hand, is the fact that its possible world is structurally different from the real one. I use the term "structural" in a very wide sense: to refer to cosmological structure as much as to social. Aesop's world differs structurally from the real world only from the biological or zoological point of view; Cyrano de Bergerac's *Empire of the Sun* and Moon shows notable cosmological differences; while Bacon's *New Atlantis* is different essentially in its social structure. We could perhaps say that the counterfactual which fantastic literature exploits is of the type: "What would happen if the real world was not similar to itself, if its structure, that is, were different?"

There are thus several paths that fantastic literature can take:

1. Allotopia. It can imagine that our world is really different from what it is; that wizards and fairies exist. It can thus construct an alternative world and assume this to be more real than the real world, so that among the narrator's aspirations is one that his reader be persuaded that this fantastic world is the one truly real world. It is typical of Allotopia that, once the alternative world has been imagined, we are no longer interested in its relation to the real world, unless it be for its allegorical meaning.

2. Utopia. Fantastic literature can imagine that the possible world it narrates is parallel with our own; that it exists somewhere but is normally inaccessible to us. This is the form a utopian story normally takes, whether the utopia be understood in a projective sense, as the representation of an ideal society, as with More, or in a caricatural sense, as the ironic deformation of our own reality, as with Swift. This world may have existed at one time or exist now in some remote point in space. Usually, it constitutes a model of the way our real world ought to be.

3. Uchronia. A utopia can turn into a uchronia when the counterfactual takes the following form: "What would have happened if what actually did happen had happened differently –

for example, if Julius Caesar had not been assassinated on the Ides of March?" We have some splendid examples of uchronic historiography being used the better to understand the events that have produced our actual history. 4. Metatopia and Metachronia. Finally, the possible world represents a future phase of the world as we have it here and now, and however different it may be structurally from the real world, the possible world is possible (and life-like) for the very reason that the transformations underlying it merely carry to completion tendencies present in the world today. This type of fantastic literature I shall define as the "novel of anticipation" and use here as the most accurate definition of Science Fiction.

I admit that there may exist stories thought of as Science Fiction which function as stories of the first type (allotopia) or even as fables, whose future worlds are portrayed as being the remote consequence of whatever is happening in our world, but where what matters is the hallucinated or hallucinatory state of the world being described. These are stories concerned less with establishing how such a world might become possible, than with what happens there. Such are our "space operas" or "bug-eyed monster" stories, and what they give us is a blandly SF version of the neo-Gothic novel. The story takes place in a world of anticipation, admittedly, but it contains no reflections about that anticipation itself. Faced with stories of this kind we need only ask ourselves whether what happens in them could not happen equally in the Earthsea of Ursula le Guin's trilogy – which is not Science Fiction, but a splendid Romance – so providing ourselves with a dividing line that tells us that such tales are not true SF.

Equally, there exist stories thought of as SF which belong to my second category, of the utopian narrative; a Science Fiction of parallel worlds. But I think there is a way of deciding whether a story about parallel worlds is SF or not. In SF the parallel world is always justified by a split or snag in the fabric of space-time, whereas the classic utopia is simply a non-place hard to identify (it may be past, or have vanished), a remote corner of our same physical world. Indeed, what matters in the utopian narrative is not the site of the possible world, or even its cosmological possibility, but what it contains and what happens there, which are a mirror for our own hopes and disillusion.

When SF talks of parallel worlds, on the other hand, it is interested more in their cosmological possibility – and the paradoxes that follow from it – than in their contents. For classical utopias predict just one parallel world, whereas SF is interested in a plurality of active parallel worlds and in the possibility of passing from one to the other (see, for example, Frederick Brown's *What Mad Universe?*). And as we shall see, the condition for explaining this cosmological possibility is always tied in some measure to the anticipatory nature of the story. The possibility is given by extrapolation from some known cosmological law.

We also have good examples of uchronic SF, where, by virtue of some given scientific discovery, not only can the past be revisited but its lines of force modified, with all the paradoxes which follow. But I would argue that even when SF becomes "story-fiction" (in Mary Wade Wellman's *Twice in Time* the protagonist is projected into the past and becomes Leonardo da Vinci), what matters is not so much the modification of history as the mechanism whereby it is achieved, that is, the cosmological possibility of travelling backwards in time and the "scientific" problem of how to project a possible history from the tendencies of the present. SF exists as an autonomous genre when a counterfactual speculation about a structurally possible world is conducted by extrapolation from certain tendencies in today's world, which is the very possibility of a "futurizable" world. That is, SF always takes the form of an anticipation and anticipation always takes the form of a conjecture formulated from existing tendencies.

Naturally, the term "science" has to be understood here in a broad sense, because I am thinking of conjectures in not only the physical sciences but also the human sciences, in sociology, history or linguistics. There can be good sociological SF (Pohl and Krombholz's *Space Merchants*) and good linguistic SF (Sheckley's

Shall We Have a Little Talk?), where the reader is not asked to split hairs over the likelihood of the technological devices assumed (space-ships or whatever) in order to account for the journey to a given place or the possibility of a particular scientific development. What matters is that a particular social or linguistic development should seem conjecturally likely.

The mechanism turns on how good the conjecture is. In this sense I would adjudge Verne's *Twenty Thousand Leagues Under the Sea* to be SF but remain unsure about Wells's *Time Machine*. That the machine itself be possible hardly matters, even in terms of the story, and as for the visit to the prehistoric people, that confronts us not so much with conjectures about a uchronic situation as with a free and adventurous fantasmatism about a lost world – nor does the novel pose (or not with any profundity) the exquisitely scientific problem of the temporal paradox.

I insist on SF being narrative of conjecture for one quite simple reason: good SF is scientifically interesting not so much because it talks of technological wonders – it may not talk of them in fact – but because it offers itself as a narrative game, played with the very essence of all science: its conjecturality. In other words, SF is a narrative of hypothesis and abduction, and thus the scientific game *par excellence*, given that all science functions either by conjecture or by abduction, as this last procedure was defined by C. S. Peirce.

Let me take up an example of Peirce's. Suppose that on this table there is a bag of white beans. I can assume as a Law that "All the beans in this bag are white". Once the Law is known I produce a Case of the Law, by extracting a handful of beans from the bag. Without even looking I can predict the Result by Deduction: "All the beans in this bag are white (Law); this handful of beans comes from this bag (Case); therefore all the beans I hold in my hand are (must be) white (Result)." With Induction it is assumed that I do not know what is in the bag. I put in my hand, I pull out several

handfuls of beans (Result) and see that they are always white. I can now infer that all the Results I have experimented with are Cases of a possible Law and that all the beans in the bag are white (Abduction).

There is no need to dwell on the risks of proceeding by induction, which have been copiously argued over for the past several hundred years. But let us see what occurs in the case of Abduction (and let me say straight away that, to keep matters short, I shall consider an extreme – that is, the holdest and most complete – case of Abduction). With Abduction I find myself faced with a Result I am unable to explain (why are there white beans on the table? where do they come from?) and I try to imagine a Law such that, if this Result were a Case of that Law, it would be wholly explicable. I therefore imagine a Law (all the beans in the bag are white) and a Case (the beans on the table come from that bag), and then imagine their close connection, so making the Result reasonable.

This is the reasoning by conjecture typical of all revolutionary scientific discovery. From his predecessors Kepler learnt that the orbit of the planets was circular. He found (an odd Result) that in its movement Mars touched two points, x and y, such that they could not be two points on a circle. The Result would no longer be odd if it was supposed that x and y were two points on another curve (first abduction) and that this curve was the one on which all the planets actually travelled (second abduction). Kepler conjectured that the curve travelled by Mars was an ellipse. At this point naturally he had to control his Abduction by a Deduction, which took the Law to be a sound one. He began from the principle that the orbit was elliptical and waited for Mars to pass through a point z, which was a point on the same ellipse as x and y. And Mars duly appeared at z. The scientist had made a conjecture rather similar to a wager, and had won. (This is an abridged account, of course. What is interesting is that a detective goes about things in the same way, as

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Potted palaeontologists

James A. Secord

GEORGE GAYLORD SIMPSON
Discoverers of the Lost World: An account of some of those who brought back to life South American mammals long buried in the abyss of time
222pp. Yale University Press. £23.50.
0300 031882

Sir Arthur Conan Doyle's *The Lost World* depicted an isolated plateau in South America, where gigantic beasts thought to have been extinct for millions of years still survived into the nineteenth century. There is, however, another and more tangible "lost world" in South America, although it is found not on a plateau but deep in the Earth's crust, and it derives not from a novelist's imagination but from two centuries of scientific investigation. In *Splendid Isolation: The curious history of South American mammals*, George Gaylord Simpson told the story of the strange creatures that once populated the continent: giant sloths and armadillos, mastodons, prehistoric horses. In this sequel to that volume, he offers biographical sketches of the creators of this fossilized lost world.

An intensely romantic aura has always surrounded the study of giant vertebrate fossils. Like the Danish naturalist, Peter Lund, in the last century, palaeontologists like to think of themselves searching the "ruins of an ancient palace of giants" for "vestiges of its immediate inhabitants". Few sciences can offer such a combination of exotic adventure, travel in distant lands, the passion of discovery, and the painstaking work of reconstruction. At the end of all these labours, huge skeletons rear up in public museums, gripping the popular imagination in a way that the more typical objects of specialized palaeontological investigation can never do. In natural history collections throughout the world, the bones of extinct mammals and reptiles almost always occupy the centre of attention.

The men who study these bones tend to be colourful characters in their own right. Georges Cuvier, Richard Owen, Edward Drinker Cope, Othniel Charles Marsh and not least Simpson himself, occupy positions of eminence granted to very few in the taxonomic sciences. Competition for unique specimens, issues of scientific property and territory, reach

their peak in the arcane arena of vertebrate palaeontology. The leading contributors are almost always strong personalities.

The individualistic cast of the subject makes the organization of the present book—a succession of potted biographies—somewhat more appropriate than might at first seem apparent. Certainly the result is an intriguing assemblage of adventurers, opportunists and egotists. Simpson's accounts are from three to twenty pages in length, and range in time from Charles Darwin (who collected important mammalian fossils on his *Beagle* trip) to work currently in progress. Prominent names include Herluf Winge, André Tournour, William Berryman Scott, Carlos and Florentino Ameghino, John Bell Hatcher, Angel Cabrera, and Carlos de Paula Couto. Many of these men are little known outside palaeontological circles, and Simpson frequently offers the only available treatment in English. Given current biases in the writing of the history of science, this is a particularly valuable feature of the book. Moreover, the author (b 1902) has been closely associated with many of the twentieth-century practitioners, and his personal recollections are often of great interest. In this sense, the book usefully supplements Simpson's 1978 autobiography.

Of course, a collection of biographies does not add up to a history, nor does the author intend to provide an analytical account of the development of South American vertebrate palaeontology. There is, for example, very little on the wider intellectual and institutional contexts of research, and almost nothing on the social, political, or religious ones. Even considered as biographies, the chapters are often extremely discursive, with bibliographies of technical papers, details of complex title pages and other trivia reported at length in the text. A great deal of attention is given to the proper pronunciation of Spanish and Portuguese place-names, but there are no maps. Perhaps most significantly, the personal judgments that enliven Simpson's discussions of his contemporaries frequently hinder the appreciation of historical figures. The author treats in the footsteps of Darwin with "a feeling of awe, or even of piety", while less congenial figures like Owen and Cuvier remain as cyphers. Frequently there is little to be said save that their work was "wrong" or "absurd". As a result, the book will be much less engaging (and entertaining) for a non-specialist audience than it might otherwise have been.

Sin and Punishment

For sins of obesity I am caught
In the trap of my boot, whose laces
Eldred my wagging fingertips,
Whose tongue will not cease
Telling my weight and fortune
Until I have performed a ritual
Humbling of head to foot.

For sins of biliousness I wear
This belt and collar, See,
By my changed complexion, how
This double ring of leaves saves
My head with its deep furrows
Of purpose and confusion
From the blood's flash floods.

For sins of false economy I fly,
As from a mant, this length of silk,
Whose broad diagonals convey
In long since broken codes
The price I may be hired at
To wear the colours of my class
And, too, the price I'm willing to pay you.

For sins of inattentiveness my eyes
Perpetually are made to kiss
These plastic discs by whose
Incessant action I may see, within
The shop windows of common agreement,
The frilly underwear of our beloved
Empress, Bärth.

TOM DISCH

At the same time, *Discoverers of the Lost World* contains many pointers to the wider importance of its subject. Vertebrate fossils, like many other natural objects, are investigated in two widely contrasted settings, the field and the museum. The distinction is epitomized by the fascinating case of the Ameghino brothers, Carlos and Florentino, both active in research in Argentina around the turn of the century. Carlos was the collector, the quiet observer who brought back specimens from the field and patiently determined the succession of the strata. Florentino was an argumentative, impetuous theorist, who wrote dozens of papers based on the family's fossil collection in Buenos Aires. As Simpson points out, the rewards for their contributions were radically different: Carlos died largely unknown, while Florentino's collected works were published in twenty-four fat volumes at government expense. When crowds of Argentinian schoolchildren sing "Gloria, gloria a Ameghino", there can be little doubt as to the subject of their praise. No wonder that one field man, less self-effacing than Carlos, pictured himself as "a real lover of nature seeking for truth at first hand", and dismissed museum workers as "birds of prey" and "parasites".

Enigmas of distribution

Wilma George

HARRY CLEMENTS
Alfred Russel Wallace: Biologist and social reformer
215pp. Hutchinson. £8.95.
009 1532701
ALFRED LANGDON BROOKS
Just Before the Origin
297pp. Guildford: Columbia University Press.
£32.50.
0231 056761

Harry Clements's posthumous *Alfred Russel Wallace* focuses on Wallace's interest in spiritualism and sociology. The Contents lists Land Nationalization, Socialism, Militarism, Spiritualism, Vaccination, Health and Disease, Poverty and Greed, The Moral Issue, The Social Ideal and Human Ecology. There are eight introductory chapters of biography: a dull précis of Wallace's own *My Life* with the wrong name copied out for Wallace's wife. There is nothing new in these introductory chapters and what follows does little more than string together quotations from the writings, making sure to stress any unorthodox opinion. Wallace was the first "protagonist of human ecology" because he "postulated the omni-ance of mind as the important factor in human evolution".

But Clements's book is a quick and pleasant read: he contrasts Wallace the man concerned with social issues—trying to apply biological theory to everyday life—with Darwin the man concerned only with biology and with shodding himself from everyday life. Clements comes into his own with social analyses of Wallace's attitude to public health, hygiene and vaccination. But it is a pity that the chapter on vaccination was not brought up to date because Wallace was scientifically opposed to the risky practice of immunization against smallpox.

Alfred Langdon Brooks's *Just Before the Origin* traces Wallace's interest in the species problem through his many years as a collector, from the wild flowers and beetles of Britain to the papilionid butterflies of the Malay Archipelago. Brooks contributes a useful analysis of *Palm Trees of the Amazon* in which Wallace describes new species—one of which still bears his name—and the distribution of species throughout the Amazon basin. Brooks again chooses to discuss aspects of Wallace's work in the Malay Archipelago which are rarely scrutinized: speciation in the bird-wing butterflies, thoughts on the classification of birds and Wallace's interest in the orang-utan as a natural relative of man. But Brooks persistently limits Wallace to the "prima goal" of solving the problem of organic change: he implies that all observations led only to the important papers on species in 1855 and 1858. It is for indications of thoughts on species change that Brooks analyses in detail the early papers,

The contrast between field and museum gains an additional dimension in a region like South America, which has often been on the periphery of international science. Typically the "field" is an impoverished district in Paraguay, Brazil or Argentina, while the museum is a well-funded institution located in Europe or North America. In this situation fossil bones can easily become involved in battles for notional prestige. Bans on the export of new specimens—like restrictions on antiquities—can serve as declarations of cultural independence. Even scientific theories sometimes become instruments of national self-definition, particularly remarkable is Florentino Ameghino's idea that all the main branches of mammalian evolution (including man) originated in Argentina.

A full account of the history of South American palaeontology will have to wait someone who can add to Simpson's remarkable linguistic, literary and technical expertise a further awareness of the tools for exploring the historical records of past science. But in the meantime his book will be useful not only to students of vertebrate fossils, but to readers wanting to examine the "lost world" of science outside Europe and North America.

from the umbrella bird of Amazonia to the natural history of the Aru Islands. The task is difficult because Wallace gives little indication—even in the jottings in his notebooks—of how his thoughts on the species problem were developing. He had, in fact, become equally engrossed in solving the enigma of the geographical distribution of animals. For Wallace, the two problems were inextricable: if it could be established that species changed, evolved and developed into other species, then perhaps he could understand the geographical distribution of species and subsequently interpret geographical change in the land. Conversely, of course, the facts of distribution would throw light on speciation. Nearly half the 1855 paper is about geography and geology and the evidence it provides for new species to come into existence from previously existing species and for the two to coexist until extinction of one of them. Wallace's views on the mutability of species by divergence were an answer to Forbes's polarity argument where the total number of species contracts between recurring temporal "poles of abundance". But Wallace realized that his continual divergence theory was only "one step in the right direction" towards solving the problem of the origin of species. Having convinced himself in the 1855 paper of organic change, the 1858 paper was a flash of insight that revealed the mechanism: natural selection. Thus, Wallace's later work used evolutionary theory to explain the facts of animal distribution. Brooks tries in retrospect to squeeze "thoughts on species" from *Malay Archipelago* but Wallace was no longer in doubt and—ten years after the *Origin*—was committed to zoogeography. *Malay Archipelago* was for geologist and "philosophic naturalist", to be able to form some conception of the order of these [land] changes, and to understand how they may have resulted in the actual distribution of animal life in these countries.

Brooks's subsequent chapters speculate on dates: the arrival of the 1858 paper at Darwin's house and the possible delay that ensued before Lyell and Hooker were informed of the catastrophe. Did Darwin spend a week or two pillaging the 1858 paper and rereading the 1855 paper? Did Darwin fail to acknowledge Wallace's priority? The evidence is inconclusive. But the evidence that Brooks's priority—in establishing the timetable of mail-boats sailing between the Moluccas and England in 1858—is not inconclusive at all. Yet Brooks makes a telling point that Wallace's paper should not have had its title changed and should have been priority over Darwin's knocked-up contribution. Darwin went on to write the *Origin*. It was simply shorter because *The Geographical Distribution of Animals*. That is history and no amount of academic quibbling about mail-boats can rewrite it.

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The triumph of evolutionary synthesis

Ernst Mayr

No other scientific theory has so fundamentally affected man's view of the world and of himself as Darwin's theory of evolution by natural selection. It challenged most of the firmly accepted beliefs of his contemporaries: a constant world of short duration, man's separate creation, the belief in divine design (natural theology), teleology in any form whatsoever, and Platonist essentialism (as more or less accepted by all philosophers). The phenomenon of evolution was soon recognized to be simply a fact, as well established as the heliocentric system. The theory of common descent, with man derived from an anthropoid ancestor, was also soon universally accepted. Even Darwin's daring speculation that all life on earth might have had a single origin, was finally proven, when the molecular biologists discovered that even the simplest forms of life (bacteria and relatives) had the same genetic code as plants and animals.

Darwin's theory of natural selection, by contrast, was unacceptable to just about everybody, excepting some naturalists, like A. R. Wallace (co-discoverer), Bates, and Poulton. Matters went from bad to worse when in 1883 Weismann denied any effect of use and disuse, or any other form of inheritance of acquired characters. (Romanes designated this theory as Neo-Darwinism.) The rejection of Neo-Darwinism by humanists, philosophers and scientists outside biology was virtually total. What was surprising, however, was that even the biologists were almost as solidly opposed to consistent selectionism. Those biologists who accepted evolution, but rejected selection, favoured one of three other options: (1) Saltationism, that is, the sudden origin of new species or types of higher categories (T. H. Huxley, Galton, Bateson, De Vries); (2) Neo-Lamarckism, that is, an inheritance of acquired characters (believed by the majority of biologists from Darwin to the 1930s); or (3) Autogenesis, the existence of an intrinsic force in organisms, that would carry them in due time to ever greater perfection—defended under such designations as orthogenesis, monogenesis (Berg), aristogenesis (Osborn), or omega principle (Teilhard de Chardin). The experimental biologists were solidly opposed to consistent selectionism far into the twentieth century, but among them no group was as scathing in its denunciation of selection as the embryologists.

In the first third of this century the evolutionists proper were split into two feuding camps, the geneticists and the "naturalists" (systematists and paleontologists). They fought each other bitterly until the 1930s, when—rather unexpectedly—a far-reaching consensus among the two groups was reached in the years 1936 to 1947, a process that was designated by Julian Huxley (1942) as the evolutionary synthesis.

In retrospect it is evident that the two camps agreed more completely in their rejection of saltationism, neo-Lamarckism and autogenesis than in the details of their own now paradigm, the synthetic theory. To be sure they all agreed that natural selection was the moving agent of evolution, and that changes in the genetic material ("mutations") were the ultimate components of the material made use of by natural selection. But this still left abundant scope for differences of interpretation. Yet, at first (1940s to 1960s), there was among the evolutionists so much happiness over the peaceful conclusion of the eighty-year-war against the temporarily silenced anti-selectionists, that the remaining differences between the camps were glossed over. In order to demonstrate the common front, naturalists like myself even adopted temporarily the absurd reductionist definition of evolution as "change of gene frequencies in populations".

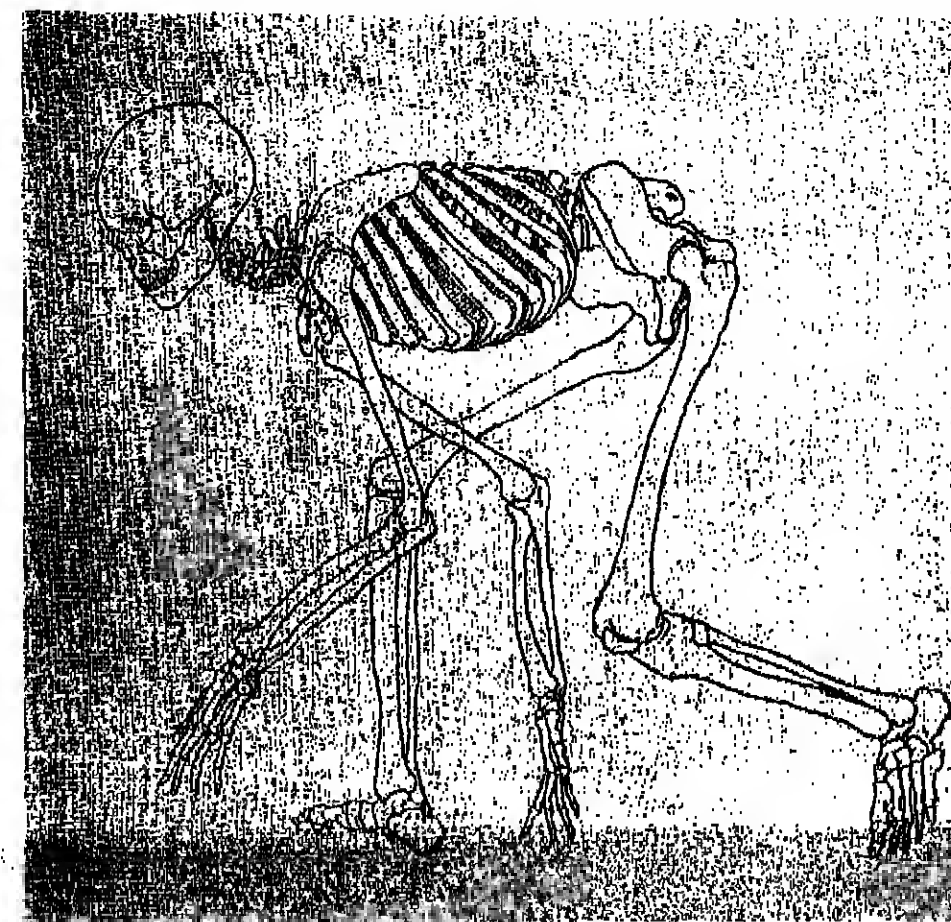
At this point a word needs to be said about the nature of the theory of evolution through natural selection. Physical theories ordinarily are either simple, quite often to such a degree that they can be expressed by a simple mathematical formula. By contrast theories in organic biology are usually highly complex, often involving several hierarchical levels and pluralistic solutions. They deserve better to be

called paradigms (T. S. Kuhn) or research programmes. When such a new research programme as the theory of natural selection is first proposed, it is bound to be very coarse-grained, containing many unknowns, often referred to in the scientific jargon as "black boxes". For instance, variation, the material sorted out by natural selection, was such a black box for Darwin. He saw everywhere in nature evidence for the abundant availability of variation, but not having a theory of inheritance (or rather—what is worse—having an erroneous one), he could not advance a valid causal explanation. And even after genetics had established an explanatory basis, conceptual confusion long prevented a universally acceptable solution.

synthetic theory of evolution and the rise of a new evolutionary theory.

Two major claims were either implicit or made directly in these publications: (1) that the recent research findings refuted Darwin, and (2) that these findings were new. This at once provoked rejoinders, as by Rhodes, A. Huxley, and others, showing that virtually all the phenomena cited as anti-Darwinian had been well known to Darwin, and that they, furthermore, were not in any way in conflict with either the classical Darwinian view or the consensus of the synthesis.

A more serious effect was that several fundamentalists now exclaimed "Great! The biologists themselves admit that Darwinism is refuted." This assertion has since been so thoroughly



George Stubbs's "Lateral view of a human skeleton": the exhibition George Stubbs (1724-1806, at the Tate Gallery until January 6, will be reviewed in next week's TLS.

The task of evolutionary biology, after the synthesis of the 1940s, was to convert the coarse-grained theory of natural selection into a fine-grained one. It was during this endeavour that it became apparent that the synthesis between the assumptions of the reductionist geneticists and the organismic naturalists had not been entirely successful. And this, by the beginning of the 1970s, led to a new wave of controversy.

The so-called architects of the evolutionary synthesis, Th. Dobzhansky (born 1900, genetics and systematics), Julian Huxley (1889, general biology), B. Rensch (1900, zoology), G. G. Simpson (1902, palaeontology), E. Mayr (1904, systematics) and G. L. Stebbins (1906, botany), considered the autogenetic shifts, the addition of new discoveries, and in fact any advances in evolutionary thinking between the 1930s and the 1980s as mere elaboration of the classical synthetic theory of the 1940s. Indeed, they felt themselves not only defenders of that theory, but even more defenders of what Darwin had proclaimed a long time ago.

This position did not satisfy a group of young Turks. Not having been involved in the pre-synthesis struggles, they took what they considered as the consensus of the synthesis as their base-line, and, in a series of publications, they tended to proclaim any modification of the synthesis as a refutation of Darwinism. For instance, S. J. Gould (1980) stated: "I think I can see what is breaking down in evolutionary biology—the strict construction of the evolutionary synthesis with its belief in pervasive adaptation, gradualism, and extrapolation of local populations to major trends and transitions in the history of life." Ho and Saunders (1984) imply that selectionists believe "that organisms, and therefore, societies and cultures, can be reduced to molecules and genes". M. J. D. White, E. Vrba and several other recent authors have proclaimed the end of the

oroughly refuted by Futuyma, Kitcher, Moore, Newell, Ruse, Ziswiler and others, that nothing further needs to be said.

But there was one effect of the recent anti-synthesis movement that was rather surprising. As already stated, criticism of selection was almost completely muted during the 1940s to 1960s period when the adherents of the synthesis showed a common front. One did not know whether criticism was absent because everybody had been thoroughly converted by the force of the argument, or whether the opponents merely kept quiet because they did not think they had the strength to battle against a doctrine so well entrenched.

That it was the second of these alternatives became apparent as soon as the cracks began to appear in the camp of the synthesists. Even a few biologists now felt encouraged to join the attack. A number of papers and books appeared, raising new and old objections to what they considered to be the Darwinian fallacy. Unfortunately these opponents were, for the most part, very insufficiently familiar with the evolutionary literature of the past thirty years.

It is a common complaint among modern scientists that the volume of the scientific literature is increasing at such a rate that they can no longer keep up with it, not even in their own field of specialization. How, then, can an embryologist, a biophysicist, not to mention a chemist or a mathematician, keep up with the latest developments in the field of evolutionary biology? Can he master that literature sufficiently well to be able to criticize it intelligently and successfully? With a few exceptions the answer, unfortunately, is: No. Such critics nevertheless consider themselves qualified to publish "refutations" of Darwinism, and since they are often presented in a highly sensational manner, the public is seduced. As a result one reads these days ever more often that the Darwinian theory is shaky and, in fact, on the point of collapsing completely. These claims

must be rejected emphatically.

How can this be done? Perhaps best by taking the criticisms of the anti-Darwinians one by one and showing that they are based on misconceptions. From the large literature I will select a recent book entitled *Beyond Neo-Darwinism: An introduction to the new evolutionary paradigm* (Academic Press, 1984), edited by Ho and Saunders. It may seem unfair to select a single volume, particularly since the editors are evidently well-qualified scientists, highly accomplished in their own fields of specialization (embryology, mathematics); but the volume is typical, and by answering it one answers much of this kind of literature. That Ho and Saunders do not understand the modern Darwinian theory is evident in their preface, and their lead article also shows that they simply do not know the literature of the field they attack. I shall not refer to the thirteen other essays in the volume, which deal with specialized subjects (some having no evident relation to evolution) and which definitely do not fulfil the promise of the subtitle of introducing a "new evolutionary paradigm".

Let me begin my analysis of Ho and Saunders by asking what they mean by "Neo-Darwinism", the paradigm they consider so wrong. They do not seem to know that this was Romanes's term for Weismannism (defined by Romanes as Darwinism without inheritance of acquired characters). Admittedly, the term has also been misused by many other recent authors. For Ho and Saunders it stands for the highly reductionist evolutionary theory of the mathematical population geneticists. Neo-Darwinism, they say, is rather comprehensively characterized by beliefs such as that "natural selection of random variations is both necessary and sufficient to account for all evolution", in other words "almost all evolution can be explained by natural selection of random mutations". They virtually single out R. A. Fisher (1930) as the father of the "neo-Darwinian" paradigm. Fisher was an intellectual giant, and at that stage in the development of evolutionary theory his consistent reductionism was the best possible strategy for advance. But to consider Fisher as the incarnation of the synthesis movement completely ignores the major developments of the ensuing forty years. Actually, Fisher was pre-synthesis, even though some of his reductionism is still alive in the writings of some geneticists.

It is rather ironical that much of what Ho and Saunders plead for is precisely what the leading Darwinians of the past thirty years have also proclaimed, a fact missed by these critics owing to their appalling ignorance of the literature. And this same ignorance induces them to express most remarkable judgments. For instance: "The neutral mutation concept [of Kimura, 1968] represents an important turning point in the history of ideas. It presaged the fall from dominance of the genetic theory of natural selection—and the concomitant return of theories on organismic structure and form". Don't they know that abundant recent research (for instance by Ayala and Nevo) has invalidated much of Kimura's sweeping claim? And don't they know that from Darwin on, for naturalist-evolutionists like myself, the individual has always been the target of selection, and that then the near-neutrality of a certain percentage of mutations becomes an irrelevant issue (they are merely hitch-hikers of successful genotypes)? Finally, don't they see that an organismic (anti-reductionist) view, such as most naturalists have maintained consistently, is not in any conflict with selectionism?

But it is not only ignorance of the literature that flaws Ho and Saunders's discussions so deeply, it is also profound conceptual confusion. One is almost embarrassed when one reads their statement: "Our common goal is to explain evolution everywhere by necessity and mechanism with the least possible appeal to the contingent and teleological". What a series of contradictions and misstatements! Is the appeal to the contingent and teleological really the hallmark of Darwinism? Don't they know that no other evolutionary theory is as anti-teleological as Darwinism, as was clearly realized from 1859 on (Agassiz, Sadleir, von Baer, etc)? Furthermore, invoking necessity means invoking some sort of teleology, thus the two halves of the statement are in conflict with each other. Finally, natural selection is a

Handwritten note in the right margin: "The individual has always been the target of selection, and that then the near-neutrality of a certain percentage of mutations becomes an irrelevant issue (they are merely hitch-hikers of successful genotypes)?"

mechanism, hence the Darwinian does explain evolution by mechanism.

Let us look at another of their uninformed statements. They plead for "a transcendence of the predominantly Aristotelian framework of neo-Darwinism – in which organisms are explained in terms of essences or genes – to the post-Galilean world view in which relation and process are primary". I shall not dwell on the point that they have Aristotle all wrong (cf Balme, Lennox, Getthelf), but stress the fact that it was Darwin, and virtually Darwin alone – together with the population thinking of the naturalists – who led to the rout of essentialism. The authors might well benefit from studying my *Growth of Biological Thought* (1982), in which the history of the fight of the Darwinians against essentialism is presented. And to imply that the Darwinians neglect "relation" and "process" is simply contradicted by the facts. May I call to their attention that the term *species* is now considered a relational term (Mayr, 1963:19–20) in contrast to earlier essentialistic conceptions? Furthermore, as an adherent of the synthetic theory I am rather amused to be accused of ignoring process, considering that I have devoted much of my scientific life to the study of the process of speciation. Indeed, my researches into isolating mechanisms, the origin of evolutionary novel-

ties, and virtually all my other evolutionary researches have dealt with processes. And the same can be said of most Darwinians, as a glance at the articles published in *Evolution* or the *American Naturalist* will demonstrate.

One is puzzled how He and Saunders have come to their curious conclusion. Perhaps it is revealed by their claim "that development and the nature of the organism rapidly come to the fore as problems unintelligible within neo-Darwinism". The suggestion that it is the task of the Darwinians to explain development (and much else in their discussion) makes it evident that He and Saunders are unaware of the important difference between proximate and ultimate causations, to use the helpful terminology of John Baker and David Lack. Expressed in modern terminology, ultimate causations (largely natural selection) are those involved in the assembling of new genetic programmes, and proximate causations those that deal with the decoding of the genetic programme during ontogeny and subsequent life.

The suspicion that He and Saunders are unaware of the importance of this distinction is strengthened by their statement that "constraints to form thus arise as a natural necessity rather than from natural selection". Constraints to form during ontogeny are, of course, controlled by the "epigenotype" (Wadding-

ton) in a sequence of proximate causations. No Darwinian would ever claim that natural selection is included in this sequence.

Many, perhaps most, developmental physiologists have fallen victim to another misconception. When criticizing Darwinism they have claimed that evolutionary change is a developmental rather than a genetic process. This formulation is based on a failure to see that the genotype, comprehensively conceived as by Lerner, Mayr and, I would presume, by the majority of modern Darwinians, is nothing but the other side of the coin of what Waddington has called so perceptively the epigenotype. All the directions, controls and constraints of the developmental machinery are laid down in the blueprint of the DNA genotype as instructions or potentialities. The implication that evolution is a matter of development and not of the genotype ignores the inseparability of the genotype and its translated product, the epigenotype. If He and Saunders were better acquainted with the evolutionary literature they would recognize that there is no conflict between the explanation of development and the Darwinism of Julian Huxley, Rensch, Simpson and Mayr, to mention the names of four of the architects of the evolutionary synthesis. Fortunately, many molecular biologists have understood the situation much better

than the classical embryologists and are now hard at work (and already somewhat successful) in showing how the instructions of the DNA are translated into developmental processes.

Space does not permit a detailed discussion of all of He's and Saunders's misconceptions. But let me raise just one or two more issues. If they understood what "random" means, they would not say: "The neo-Darwinian concept of random variation carries with it the major fallacy that everything conceivable is possible". Actually, in every evolutionary text it is stressed that "random" in this context simply means that the given variation "is not a response to an adaptational need of the organism". Furthermore, every biologist has known since Cuvier's time that the potential for evolution is very severely constrained by phylogenetic heritage and constructional possibilities. Darwin knew that and Weismann discussed it repeatedly: No lineage of mammals will ever give rise to a bird or vice versa, he said. No Darwinian would ever make such a silly statement as "that everything conceivable is possible". To be sure, constraints on selection have been particularly actively discussed in the recent literature (Reif, Gould and Lewontin, Mayr), but simply in order to remind the reductionists of something every naturalist had known since Cuvier's time.

Let me make one more point that is very important for the understanding of Darwinism, although touched upon by He and Saunders only tangentially. Darwin solved the 2,000-year-old dilemma, *chance or necessity*, by developing his two-step theory of natural selection. During the first step, the production of variation (consisting of the sequence of chromosomal processes during meiosis, recombination, the meeting of the sex partners, and the meeting of the gametes), everything is largely governed by chance. During the second step, selection *sensu stricto* (beginning with the fertilized egg through ontogeny, to successful reproduction of the adult), everything is largely controlled by the quality of the genotype, not phenotype, even though with a very strong probabilistic component. For this reason natural selection is neither a chance phenomenon (not true for the second step) nor a deterministic one. It is the escape from these two extremes which gives evolution by natural selection its extraordinary flexibility.

The richness of the conceptual framework of modern Darwinism can be appreciated only by those who take the trouble to become acquainted with the literature. It is drawing a caricature of the synthetic theory, if one assumes that the Fisherian paradigm of the 1930s is typical of it. It ignores the very strong camp within the synthetic theory which consists of naturalists, zoologists, botanists and paleontologists who have consistently stressed the whole organism and its role in evolution. It turns out, or at least it seems to me, that the "new paradigm" pleaded for by He and Saunders has been alive and well ever since the evolutionary synthesis of the 1940s.

There are still enormous unsolved problems in evolutionary biology. Interestingly, most of them centre on that problem of problems, the internal structure of the genotype and its translation into the developmental machinery which – interacting with the environment – makes the phenotype. Those developmental biologists who will work on this problem, together with the molecular biologists, will certainly make a far greater contribution to our understanding of evolution than those who profess to do "world's a completely erroneous picture of the world": a completely erroneous picture of the world's state most emphatically, none of the recent developments contradicts or refutes the basic Darwinian paradigm in any way whatsoever.

Extinctions, edited by Matthew H. Nitecki, contains eight essays designed to "answer the need for a sophisticated and current theory into the causes, effects, and processes of both mass extinctions and those on a smaller scale." (363pp. University of Chicago Press, 1991, paperback £14.70, 0 226 58600 1). Contributions include "Death of Species" by David M. Raup; "Mass extinctions: A Darwinian role for temperature" by Steven M. Stanley; and "Normal" extinctions of plants and animals" by Jared M. Diamond.

Master of the bones

Martin Rudwick

DORINDA OUTRAM
Georges Cuvier: Vocation, science and authority in post-revolutionary France
299pp. Manchester University Press. £25.
0190 10772

A man who was praised by his contemporaries as the modern Aristotle and the "legislator of science", and vilified by a later generation as the reactionary enemy of evolutionism, poses acute problems for the modern biographer. Cuvier's life and work, his science and politics, and above all his character and personality, have been for such diverse and generally moralistic purposes that the man himself is hard to find. Even by the standards of nineteenth-century science, Cuvier's biographical tradition is almost unmatched for obfuscation. Yet Cuvier himself began the process; few scientists have been so concerned with self-presentation and image-building.

Dorinda Outram is not one to have any wool pulled over her eyes. Her book is not the full-scale biography she promised some years ago, but it is hardly less valuable for that. It is also not primarily about Cuvier's science, for which the reader should still turn to William Coleman's pioneering study, *Georges Cuvier: Zoologist* (1964). Indeed, without some understanding of Cuvier's work in comparative anatomy, and its relation to that of his opponents, some of the implications of Dr Outram's study may be missed. But part of her demythologizing project is to show how Cuvier's science cannot be isolated from his politics, nor his

politics from his science; for that image of science as neutral and apolitical was promoted by Cuvier himself and by his early biographers for evident political reasons of their own.

However, readers who expect an updated version of the traditional view of Cuvier as an arch-conservative and a biblical literalist are in for a shock. Outram's unrivalled knowledge of the archival record has led her to a very different picture of the man. Cuvier appears here culturally as a cosmopolitan, religiously as an Enlightenment deist and irreverent anti-clericalist, and politically as a liberal who during the Revolution was at least on the edges of radicalism. Later, in positions of power during the Empire and under the restoration, he was a conscientious defender of the rights of his fellow-Protestants; yet his pious daughter felt it necessary to pray for his conversion.

One of the merits of Outram's book, and one that should make it essential reading for would-be biographers of other successful scientists, is that it delves behind the pre-ordained inevitability that his career acquired in retrospect, not least through his own efforts. Cuvier emerged from bourgeois origins in a small Franconian dependency of Württemberg, and it was only through a highly contingent series of setbacks, opportunities and gambles that he reached a sense of the possibility of a scientific career. Having gained a foothold in Parisian science through radical contacts he was later careful to suppress, he skillfully exploited the ambiguities into which the patronage system of the *ancien régime* had been thrown during the Terror.

But the progress of his career was far from easy and never without opposition. Always

vulnerable to sniping on account of his Pretestantism and his non-French origins, Cuvier had to deploy his resources as a patron with as much care and persistence as in his earlier role as the protégé of others. Repeatedly embroiled in controversy, he gave no mere and no warlike than he received from his opponents: the old tales of his arrogant crushing of the pliable Lamarck with little credibility from Outram's revisionist account. What such controversies display is, rather, the skilful use of diverse arenas of debate: personal attacks that were acceptable in lectures for the general public were ruled out of order in the more august setting of the Institut. There Cuvier used all the weight of his authority as Permanent Secretary to foster an austere and apolitical image of scientific argument, in order to demarcate "real" science from the pretensions of populist pseudo-sciences like phrenology.

Yet in the celebrated *Discours* prefixed to his great *Recherches sur les ossements fossiles*, the "master of the charnel house" ignored his own expedient demarcation, and hitched a romantic image of himself as "antiquaire d'une espèce nouvelle" on to the sober technicalities of vertebrate palaeontology. Although his work was used by others in defence of "scriptural geology", Outram argues persuasively that Cuvier's own primary aim was to detach scientific geology from biblical preoccupations and to reorient it towards the sense of history, towards the unaided human discovery of past time – a project to be pioneered, of course, by himself.

Outram insists on the need to reorient the study of early nineteenth-century science itself – and, one might add, not only French science –

away from the current preoccupation with professionalization and scientific institutions. Using Cuvier as a case-study, she shows how at that period the formal structures of institutions like the Museum were far less important for scientific work than the informal ties of friendship, marriage and extended family, and the network of patronage that was constructed from such ties. In her conclusion, Outram hints that a more general study of the operation of patronage is still to come; but even this present case is enough to suggest rich possibilities of reinterpretation.

Ultimately, however, her perceptive reconstruction of the political and social realities of Cuvier's life will need to be integrated even more firmly into the fabric of his scientific work. While rejecting any simplistic correlation between Cuvier's science and his politics, she does suggest some of the ways in which the direction and content of his research were at least constrained by his career choices. Most notable was his early decision to remain at the Museum when his collaborator (and later opponent) Geoffroy St Hilaire joined Napoleon's expedition to Egypt; for this entailed, or at least occasioned, Cuvier's momentous move into the analysis of "dead" comparative anatomy, at the expense of any significant study of live animal behaviour. What remains to be explored more thoroughly, however, is the way Cuvier utilized not only his network of patronage in Paris but also his wider international network of fellow-savants, in order to tackle the scientific problems to which his vocation had led him. Only when that has been done will the master of the bones be fully reconstructed.

History of Science Titles

Martin Nijhoff Publishers

Uneasy Genius. The Life and Work of Pierre Duhem

STANLEY JAKI
1984, xii + 472 pp.
Cloth £44.50 / Dfl. 175.— ISBN 90-247-2897-5
INTERNATIONAL ARCHIVES OF THE HISTORY OF IDEAS 100
This is the first comprehensive and thoroughly researched study of the life and work of Pierre Duhem, who, almost 70 years after his death in 1916, remains a towering figure in the three fields of physics, philosophy of science, and history of science.

Mary Somerville and the Cultivation of Science, 1815–1840

ELIZABETH CHAMBERS PATTERSON
1983, xiv + 264 pp.
Cloth £22.75 / Dfl. 90.— ISBN 90-247-2823-1
INTERNATIONAL ARCHIVES OF THE HISTORY OF IDEAS 102
This unique book provides the first detailed account of Mary Somerville, the undisputed 'Queen of Nineteenth-Century Science'.

La Physiologie des Lumières

Empirisme, Modèles et Théories
FRANÇOIS DUCHESNEAU
1982, xxi + 611 pp.
Cloth £46.95 / Dfl. 185.— ISBN 90-247-2500-3
INTERNATIONAL ARCHIVES OF THE HISTORY OF IDEAS 32

The Transcendent Science: Kant's Conception of Biological Methodology

CLARK ZUMBACH
1984, xii + 165 pp.
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Eliciting imperfect assent

Peter Medawar

JOSEPH LOPREATO
Human Nature and Biocultural Evolution
30pp. Allee and Unwin. £20.
003730172

The rise and fall of nations; the stratification of human societies into different social classes; the tendency of human society to form tribal congregations and the enmities between tribes; human aggression and possessiveness; the ability of some and inability of others to procreate: the common *thema*: the belief that all these traits are genetically determined is the distinguishing mark of the syndrome of *geneticism*; a grievous aberration of thought of which educated biologists are not normally guilty, though some have been persuaded to become so by the recent revival of these determinist ideologies in E.O. Wilson's influential and widely read text on sociobiology (1975).

Joseph Lopreato has swallowed it all book, line and linker and the book under review is a veritable gallimaufry of ideas of the kind many biologists have found wanting.

Sociobiology is not in my view a recognized branch of biology, such as biochemistry or physiology may be said to be, but is rather the pursuit of enthusiasts who, like nature philosophers, quote each other's opinions with a gravity and respectfulness they do not always deserve and who communicate with each other in a terminology that strikes me as designed less to display the riches of sociobiology than to conceal its poverty. Its locutions are not likely to be familiar to readers of the *TLS*. Thus "human nature", writes Lopreato, in "what this volume will call a set of genetically-based behavioral predispositions that have evolved by natural selection in part at least under the pressure of sociocultural evolution."

Ne chapter in Lopreato is more likely to arouse general interest than chapter eight: "Behavioral Predispositions and Religious Behavior". But the author recommends that before embarking on chapter eight the reader should refresh his knowledge of chapter six on the "Evolution of the Soul". Unhappily, there is much in chapter six to arouse grave misgivings. Although the Darwinian evolution of human behaviour has posed a notorious and difficult problem for sociobiology, it has now been solved, to the satisfaction of most biologists, by what about a million selections, in form, by Jared M. Diamond.

Durkheim's view this behavioural trait comprises the uniquely human sentiments that prompt the human being to seek sufferings or abstain from pleasures without design of personal advantage. How can such a trait come into being through natural selection? Taking the clearly tenable view that a certain accession of braininess was a necessary precondition for the evolution of the control of drives and appetites Lopreato cites with approval the following explanation by another member of the coterie of how this accession of braininess came about:

The whole process of enlisting the neo-cortex to take-off point was based on competition between the dominant and sub-dominant males in which those who survived were those best able to control and inhibit, and hence tame, their response. Here then are the beginnings of deferred gratification, conscience and guilt, spontaneous inhibition of drives, and many more other features of a truly human state.

This kind of explanation has to my ears the kied of "Olympian gibberish". I found (*Phile's Republic*, 1983) in psychoanalytic interpretations of such phenomena as antisemitism, homosexuality and endogenous depression. The multiplication of *ad hoc* explanatory concepts makes it possible to explain anything: I am reminded of those exercises in curve fitting which are successful because the mathematical function used contains more parameters than the number of points in the set to be fitted by the function. I find something of this same spirit in sociobiological interpretations of, for example, homosexuality, chastity and self-deception ("a salient of human behaviour").

Now how about the soul? Lopreato explains it thus: my self-image and my very sense of being are intimately tied to the social self and existence of multiple others. The existential question now arises: what happens to me when they die? If they thereby cease to exist, I am a moral, emotional, and cognitive cripple. For they are no longer available to constitute and attest to the wholeness of my social and moral existence. Thus, the tendency towards the maintenance of personal integrity – of a coherent self-image – may well encourage the denial that the persistence of an individual is coterminous with the life of her body. From another perspective, the fact that the memory of the I persists in relation to the departed others may be an indication that their own persistence is assured in the presence of the living.

I tentatively submit that, as the social self is developing in the course of human evolution, a related tendency also developed to coalesce of death as a purely organic event and the dimensions of the individual, These came to be known as the "soul".

"Clean", I murmur.

Having satisfied himself that the soul is a "cultural byproduct of the natural selection of self-deception" Lopreato turns now, in chapter eight, to a discussion of the "explanatory urge" – of that which Immanuel Kant once described as the "restless endeavour" to get at the truth of things. Lopreato tells us that one of the most unique (*sic*) phases of *homo sapiens* is the inexhaustible urge to find the "cause behind the Creation, the purposes for which human life was ordained, the causes of good and evil, the causes of tides, of capitalism and communism, of happiness and misery". In short the manifold problems of the origin, purpose and destiny of man. There is nothing to cavil at here except perhaps the unexpectedly purple coloration of the whole passage; though we might also find some reason to question Lopreato's notion that "the explanatory urge underlies religious (and magic) behaviour as well as scientific conduct". The "transcendental fictions" are made all the more attractive by the paradox that afflicts all scientific explanation, namely that the more, and the more successfully we explain things the larger becomes the frontier between what we know and what still remains

Inky inklings

Harold Carter

D. J. CARR (Editor)
Sydney Parkinson: Artist of Cook's Endeavour voyage
300pp, with colour illustrations. Croom Helm. £29.95.
07099 0747X

Here, effectively for the first time in one book, is a sufficient sample from the pictorial relics of the Endeavour voyage (mainly drawn under the organizing direction of Joseph Banks) well illustrating their scope and variety as important records in their own right and not as subsidiary adornments of other works. With 253 plates, 132 in colour, this was a rare occasion for showing to advantage what has been conserved and concealed for so long in Bloomsbury and South Kensington. It is a pity, then, that the individual contributions have not been cleared of inconsistencies, some vain repetition and simple errors.

An occasional whimsy tinges the two opening chapters by Wilfrid Blunt on the voyage itself and on Parkinson as an artist. Here and elsewhere some trimming could have made

to be found out – the interface between light and darkness. What is not known or understood the reform goes in step with science which "tends to undermine its seeming dominance by fatiguing the human need for certitude".

Turning now again to the soul, Lopreato writes that it is not unreasonable to suppose that, under the pressure of the need for social approval, the explanatory urge could operate in such a way as to sublimate, to an extent, the immortal tendency of the soul into the mortal fiction that has been termed the soul. The scenario in principle is simple. All that is needed is the development of the concept of immortality.

I have written enough to give a general idea of the character and flavour of this book and cannot but reflect that belief in sociobiology has something in common with religious belief, namely that both, to my mind, depend upon that which Kant described as "a kind of consciously imperfect assent". I am one of those biologists who do not believe in sociobiology and have not yet been convinced that sociobiology is a "science" in the sense in which we would use that word of physics and chemistry or indeed biology itself.

room for professional treatment of the ethnographic material to match, for example, Jeremy Spencer's useful section on the coastal profiles and landscapes. To the Parkinson head itself, working with fresh material on the voyage, botany has clearly most to offer in the completed drawings of plates 41 to 101, Madeira to the Society Islands, well annotated by Edwards, Fosberg and Sachet. However, for New Zealand, Australia and Java the plates 102 to 195 are not really Parkinson's but brilliant reconstructions from field notes and herbarium specimens, drawn in London, mainly by Frederick Nodder and John Frederick Miller. For these an enlightening text is provided successively by Godley, Henderson and Stearn. However in the zoological drawings of plates 186 to 248, admirably fortified by Wynne Wheeler's discursive notes, Parkinson's progress as a technical draughtsman reappears in his productive four years under the critical direction of Banks, his employer. *Sydney Parkinson: Artist of Cook's Endeavour voyage* provides an inkling of what the published scientific record of the voyage might have shown had the original Banksian plans been fulfilled. To this, other publications now pending will soon testify in support.

Between Brahe and Baer

John North

N. JARDINE

The Birth of History and Philosophy of Science: Kepler's A Defence of Tycho against Ursus with essays on its provenance and significance 301pp. Cambridge University Press. £32.50. 0521 252261

The *Apologia pro Tychone contra Ursum* was written around the end of the year 1600 by the best theoretical astronomer of his age, in defence of the best observing astronomer — who happened to be his employer. Its author, Johannes Kepler, was not yet thirty. Tycho Brahe, Danish nobleman and by now a satellite of the court of Rudolph II in Bohemia, was in his fifties, and had less than a year to live. The *Apologia* was an embarrassment to the younger man, but he was under a strong moral obligation to issue it. In 1595, as a young man with his way to make in an inhospitable part of the world, he had written to Nicholas Reymers Baer (the "Ursus" of the title) in praise of his mathematical talents — a safe enough gesture to make towards the Imperial Mathematician. Baer included the letter in a work of 1597 that bitterly attacked Tycho, who was not amused. When Tycho died, the unpublished manuscript copy of Kepler's defence passed into that limbo to which only historians have access.

It was first published by C. Frisch in 1858 for his collected edition, and has been discussed sporadically since then, but never with the care now accorded to it by Nicholas Jardine. Nearly half of his book is taken up with a new edition and translation of the original — the former done from the autograph manuscript, now in the USSR, although parts of this have been lost since it was seen by Frisch. Variant readings from Frisch's edition are something that historians of the history of science will have to provide for themselves. The letter is one thing, the spirit another, and this is its editor has captured well. His title gives away his belief "that if any one work can be taken to mark the birth of history and philosophy of science as a distinctive mode of reflection on the status of natural science it is Kepler's *Apologia*".

A number of different views have been taken of Kepler's posture in this *opusculum*, even so. Karl von Prantl (1875) held to esteem its solid inductive method — so different, he thought, from the wild metaphysics and theology of Kepler's earlier writings. Not that this was a new perspective on Kepler: of his *Astronomia nova* Robert Small had written in 1804 that "it exhibited, even prior to the publication of Bacon's *Novum Organum*, a more perfect example than perhaps ever was given, of legitimate connection between theory and experiment; of experiments suggested by theory, and of theory submitted without prejudice to the test and decision of experiments". Such were the prevailing attitudes to scientific respectability in the last century. Jardine, like a number of other modern interpreters, is able to find common ground between the *Apologia* and the earlier *Mysterium Cosmographicum*. Both works include a plea for the founding of astronomical hypothesis in physics and metaphysics. The central theme of the *Apologia* concerns the establishment of criteria for the resolution of theoretical dispute, and the occasion for its composition was a sceptical attack on a position towards which — in the last analysis — he was essentially sympathetic.

It is ironic that it should all have begun with a dispute with Tycho over priorities, for Tycho's own view of his supposedly plagiarized world-system was not cast in the same sceptical mould as Baer's, by any means. As a taste of Tycho's argument, the Earth cannot have the triple motion Copernican astronomers advocate, since (a good Aristotelian argument) this a single body can only have a single natural motion. Tycho was a creature of the cold northern nights; it was easier to be a sceptic in the warm logic schoolroom. Although its history is venerable, the notion that astronomical hypotheses carry with them no implications as to the reality of the things they seem to describe had been given excellent publicity in the sixteenth century through the anonymous preface to the *De revolutionibus*. (This had been penned by Osiander — as Kepler was the first to prove — and was not true to Copernicus's sentiments.) The Tychoian system is merely justified

to the Copernican, although for Tycho, the Earth was at the centre of the planetary system. (It is as though he had simply taken out the drawing pin from the middle of Copernicus's diagram, where it was near the Sun, and inserted it through the Earth). To us it might seem rather obvious, but in fact Tycho was stung by Kepler's perfectly justifiable remarks made on a number of occasions, that the transformation was a simple one, and that it had been affected by others, probably independently.

Tycho would have had them all stigmatized as plagiarists — and indeed one of the more colourful stories of supposed scientific plagiarism centres on Baer's visit to Uraniborg, Tycho's Danish observatory. A student warned Tycho of Baer's suspicious behaviour. (He was, after all, a farmer's boy from Dittmarschen.) A certain Andreas searched Baer in his sleep, and removed from his pockets papers, the loss of which began a mental disturbance that led to his eventual loss of patronage. Things are much better in Denmark now.

There is more than colour in this dispute, for from it we may learn something of what the disputants thought was the nature of the stolo intellectual property. They complained of the appropriation of constructions, inventions, formulae and associated tables, but not of fully articulated world-systems. It was here that Kepler showed his deeper insight than either of them, in insisting that Tycho's claims hinged on what Jardine calls "his articulation of a detailed system of astronomical hypotheses answerable to careful observation... something approaching the modern notion of a theory...". A particularly telling sentence in the *Apologia* includes the words "when we speak in the plural of astronomical hypotheses... we designate thereby a certain totality of the views of some famous practitioner".

In addition to the philosophical content of its opening section, Kepler's defence was steered into a historical direction by Baer's having maintained that the Tychoian hypotheses had been anticipated by Apollonius, as well as by Copernicus. If his essay seems at times historically naive, that is in part to be explained by a lack of texts — and of this he was very conscious. His interpretation of those he possessed is generally well balanced, even when he is constrained by the need to refute Baer point by point. It cannot have been easy, with Tycho at his elbow.

Jardine does not acknowledge the existence of a "historiographical category even approximately corresponding to history of science in the sixteenth century", but accepts the genre of what he calls "prefatory histories" — such as are embedded in dedicatory letters, prefaces and so on. No doubt he is right to see in them at least a part of the tradition of the *Apologia*, but it would be a mistake to overlook the pre-occupation astronomers have always had with history. History, for astronomers, was a potential source of empirical data, and valued accordingly. It was a part of the astronomer's experience that did not usually reveal itself to his writing, although there was a long tradition of listing genealogies of doctrines (Adam, Abraham, Hermes, Timochares, Hipparchus and so on) which has left its traces in the work. Then there was the Renaissance ambition, if not to recover the great achievements of antiquity, at least to provide one's subject with dignity by association. Thus Kepler — as Bruce Eastwood has shown — tried hard to establish a pedigree for the geohelocentric notion back to Plato. He also made use of a third historical genre fostered by astronomers — that which relates human affairs, in particular religious affairs, to the conjunctions of the planets. Although assembled with his customary nerve, these elements in Kepler's writing are not in character very startling. Jardine is hardly stretching a point, though, when he insists that "as a deeper level" [Kepler] is concerned to validate both his own view of astronomy as a discipline that has yielded ever greater insight into the constitution of the world and his own account of the means whereby such progress can come about through integration of mathematical astronomy into natural philosophy.

This brings us to the philosophical treatment according to the arguments offered by the sceptical (as well as virulent) Baer on the status of astronomical hypotheses. Both Baer and Kepler

Indulged in somewhat fanciful histories of the meaning of the word, but Kepler took the biscuit for rhetorical skill in his use of the device of *coloratio*, insinuating, as Jardine has it, "the impropriety of a sceptical attitude to astronomical hypotheses, intimating that in the transfer of the term from geometry via logic to astronomy the term preserved its original connotations of certainty and evidence". But then we come to the nub of their disagreement. For Ursus, it was a well-worn truth that accurate prediction does not guarantee the validity of any astronomical hypotheses on which it is based, since true conclusions may follow from false premises. This was a simple logical point, and one often made in the same context in the Middle Ages. Astronomy has long been rich in observationally more or less equivalent models, whose truth was thus seen as either on open question, or one to be settled in some other way.

To this appealing argument Kepler answered essentially that (to take an example) the astronomical system of Ptolemy merely predicts phenomena, whereas the equivalent Copernican astronomy reveals in addition their *cause*. Copernicus did not deny the ancient hypotheses, but incorporated them in his system, which was to be preferred (so he seems to be saying) by virtue of its "most beautiful regularity". But then he seems to wish to speak of at least some of the kinematically equivalent hypotheses as false — as capable of yielding accurate predictions only by chance, and in the short term. Let them be used long enough, and we shall find them out. Jardine is right to remark the difficulties of the relevant passages from the *Apologia*, but it has to be said that Kepler's argumentation, while rhetorically strong, is essentially dependent on unsubstantiated hints as to aesthetic qualities, simplicity, harmonic elegance and the sort of arguments from physics that he had offered in the *Mysterium*, and was currently deriving from Gilbert's *De magnetibus*. It is easy to agree with him that such things matter; and yet as good as one's opponent has been persuaded to accept the additional criteria for the comparison of theories, the same old problem as started the dispute might very well reappear — and where then does Kepler hope to turn?

If Kepler's position is a difficult one to hold — and I suspect that he has more supporters than critics — this is not to say that there was much to be said for the opposite camp in the sixteenth century. The tendency for philosophers today is to regard the opposition as monolithic, as "fictionalists", to use the current term of mild opprobrium. This is to blur a great many shades of opinion. Jardine does a useful service in drawing some of the necessary historical distinctions. There were, for instance, those who denied the possibility of knowledge of the heavens — not necessarily a universal scepticism, for even in modern times astronomy has been regarded as unusual in that we cannot substantially alter its subject-matter. There were those who took Ptolemy to be acceptably accurate but doubtfully true. There were the theologians like Osiander, who wanted to play safe, for doctrinal reasons. There were the astronomers who wanted to avoid debate with the natural philosophers. Most scholars of the time would indeed have thought such debate improper, for reasons Aristotle had made plain, when he split the world into terrestrial and celestial realms. There were neo-Platonic sceptics, even those who argued for an astronomy without hypotheses as the Babylonians were supposed to have had, deriving their precepts (hypotheses?) from tables of observations. This was the view of the influential Ramus. Throughout, however, one thing is noteworthy: to one was proposing what is sometimes misleadingly called the "instrumentalist view", namely that truth and falsity are not predicable of astronomical theories, or indeed of scientific theories of any other sort. Pierre Duhem has misled philosophers on the fringes of history for far too long into thinking that what Jardine calls the "pragmatic compromise" of Kepler's opponents was either a general epistemological stance or an endorsement of sceptical epistemology. What they stated was a reluctance to assimilate natural philosophy to astronomy. Kepler's greatness was not that of a philosopher (in the modern sense), but of an architect of such assimilation.

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The book by William Alexander McClench reviewed by Joseph Rykwart in the TLS of September 14 is entitled *The Architecture of Paradise*, not *The Adventure of Paradise* as incorrectly stated in the publication details preceding the review. We apologize for this error in transmission.

John Steane is the author of *The Great Year*, 1974, and not *The Record of Steane* as stated in "Among this week's contributors". In our issue of October 12,

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Resources

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To effectively provide materials which reflect the real needs of the community as a whole, and not just the demands of a minority of current library users, is the prime task of this post. You will have extensive knowledge of the book trade, bibliographical systems, the provision of audio-visual services, efficient selection, acquisition and delivery, and contemporary approaches to the presentation, exploitation and evaluation of resources.

Job share applications will be welcomed with or without a partner.

Application forms are available from John Penney, Head of Personnel Services, Town Hall, Mare Street E8 1EA or telephone 01-885 6331 (24 hour answering service) quoting reference.

Closing date 16th November 1984.

The Council intends to decentralise its services, therefore the duties, hours of work or location of these posts(s) may be subject to change.

(8429)

HACKNEY COUNCIL
Working for local people

We positively welcome applications from black people, disabled people and women where they are under-represented in particular jobs.